

32 kHz Motherboard Frequency Generator

General Description

The ICS9133X is designed to generate clocks for all 286, 386, 486, Pentium and RISC-based motherboards, including laptops and notebook computers. The only external components required are a 32.768 kHz crystal and decoupling capacitors. The device generates the 14.318 MHz system clock, eliminating the need for a 14.318 MHz crystal. High performance applications may require high speed clock te rmination components. The chip includes three independent clock generators plus the 32.768 kHz reference clock to produce all necessary frequencies, including real time clock/DRAM refresh, master clock, CPU clock, twice CPUclock frequency, keyboard clock, floppy disk controller clock, serial communications clock and bus clocks. Different frequencies from clock #2 can be selected using the frequency select pins, but clock #1 will be at 14.318 MHz for all standard versions.

VDD32 Supply

The ICS9133X has a separate power supply for the 32.768 kHz oscillator circuitry. This allows the 32 kHz clock to run from a battery or other source while the main power to the chip is disconnected. The VDD32 supply is guaranteed to operate down to +2.0V, with the clock consuming less than $10\mu A$ at +3.3V with the main VDD at 0V.

The frequencies and power-down options in the ICS9133X are mask programmable. Customer specific masks can be made and prototypes delivered within 6-8 weeks from receipt of order. Integrated Circuit Systems also offers standard versions, such as that described in this data sheet.

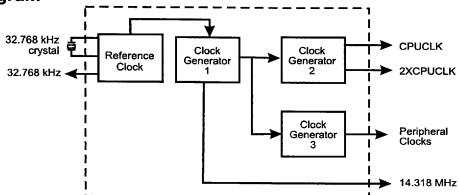
Features

- Single 32.768 kHz crystal generates all PC motherboard clocks
- Cost-reduced version of popular ICS9132
- Contains internal crystal load capacitors and feedback bias
- 3 independent clock generators
- Generates CPU clocks from 12.5 to 100 MHz
- Up to 7 output clocks
- Separate VDD for 32 kHz clock
- Output enable tristates outputs
- Power-down options available
- Operates from 3.3V or 5.0V supply
- Operates up to 66 MHz at 3.3V
- Skew controlled 1X and 2X CPU clocks
- 20-pin PDIP or SOIC package

Applications

Notebook/Palmtop Computers: The ICS9133X works with +3V and +5V and a single 32.768 kHz crystal, making it the ideal solution for generating clocks in portables with minimum board space. The user can save power by using this single part instead of oscillators or other frequency generators. The ICS9133X further reduces the current consumption by having the ability to completely shut down the individual clocks when not in use, while still maintaining the separately powered 32.768 kHz clock.

Block Diagram



ICS9133XRevA052897P

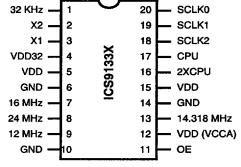
ICS reserves the right to make changes in the device data identified in this publica tion without further notice. ICS advises its customers to obtain the latest version of all device data to verify that any information being relied upon by the customer is current and accurate

4825758 0002728 828 **=**

ICS9133X



Pin Configuration



20-Pin PDIP or SOIC

Decoding Table for CPU Clock

SCLK22	SCLK21	SCLK20	2XCPU	CPU
0	0	0	8	4
0	0	1	16	8
0	1	0	32	16
0	1	1	40	20
1	0	0	50	25
1	0	1	66.6	33.3
1	1	0	80*	40*
1	1	1	100*	50*

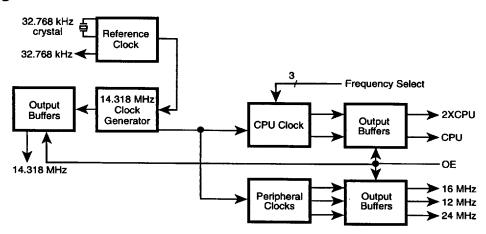
^{*} Only at 5V supply voltage

Pin Descriptions

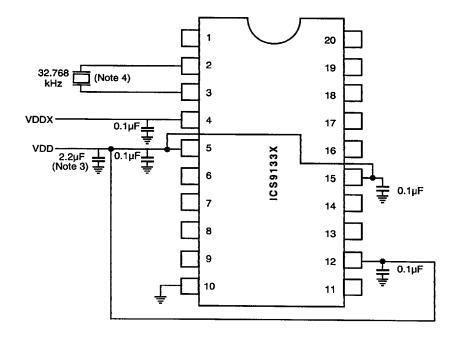
PIN NUMBER	PIN NAME	ТҮРЕ	DESCRIPTION
1	32 kHz	Output	32.768 kHz buffered output, powered by VDD32.
2	X2	Output	Connect 32.768 kHz crystal. Includes internal XTAL load capacitance.
3	Χı	Input	Connect 32.768 kHz crystal. This pin includes internal XTAL load capacitance and feedback bias for a 32.768 kHz crystal.
4	VDD32	-	Power supply for 32 kHz oscillator only.
5	VDD	-	Power supply (+3.3 to +5.0V).
6	GND	-	GROUND.
7	16 MHz	Output	16 MHz clock output.
8	24 MHz	Output	24 MHz clock output.
9	12 MHz	Output	12 MHz clock output.
10	GND	-	GROUND.
11	OE	Input	OE tristate outputs when low. Has internal pull-up.
12	VDD	-	Power supply (+3.3 to +5.0V).
13	14.318 MHz	Output	14.318 MHz clock output.
14	GND	-	GROUND.
15	VDD	-	Power supply (+3.3 to +5.0V).
16	2XCPU	Output	2XCPU clock output (see decoding table).
17	CPU	Output	CPU clock output (see decoding table).
18	SCLK2	Input	CPU clock frequency SELECT2. Has internal pull-up.
19	SCLK1	Input	CPU clock frequency SELECT1. Has internal pull-up.
20	SCLK0	Input	CPU clock frequency SELECTO. Has internal pull-up.



Block Diagram for ICS9133X



Recommended External Circuit



Notes:

- 1. The external components shown should be placed as close to the device as possible.
- 2. Pins 5 and 15 should be connected together externally. One decoupling capacitor may suffice for both pins.
- 3. May be part of system decoupling.
- 4. Crystal load capacitance and feedback bias contained internally on the X1, X2 pins.

3

4825758 0002730 486

ICS9133X



Absolute Maximum Ratings

VDD referenced to GND	
Operating temperature under bias	0°C to +70°C
Storage temperature	40°C to +150°C
Voltage on I/O pins referenced to GND	GND -0.5V to VDD +0.5V
Power dissipation	

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and 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 may affect product reliability.

Electrical Characteristics at 3.3V

Operating $V_{DD} = +3.0 \text{V}$ to 3.7V; $T_A = 0^{\circ}\text{C}$ to 70°C unless otherwise stated

,		DC Characteristics				
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Low Voltage	VIL		-	-	0.2VDD	V
Input High Voltage	Vih		0.7Vdd	-	-	V
Input Low Current	ItL	Vin=0V (Pull-up)	-12	-	-	μΑ
Input High Current	ин	VIN=VDD	-2	-	2	μA
Output Low Voltage ¹	Vol	IOL=4mA	-	-	0.1	V
Output High Voltage ¹	Voн	IOH=-1mA	VID1V	-	-	V
Output High Current ^l	Voн	Iон=-4mA	-		-	V
Output High Current ¹	Voн	IoH=-8mA	2.4		-	V
Output Frequency Change	FD	With respect to typical	-	.005	0.05	%
over Supply and	1	frequency ¹				
Temperature ¹						
Short Circuit Current ¹	Isc	Each output clock	-	15	-	mA
Supply Current	IDD	No load, 40 MHz	-	10	-	mA
Vttp32 Supply Current	IDD 32	No load, VDD32=3.7V	-	5	12	μА
VID32 Supply Voltage	VDD 32	VDD=0 to 3.7V, 32 kHz output	2.0	-		V
		operating				
Pull-up Resistor Value	Rpu		-	620	-	k1/2
		AC Characteristics				
Input Clock Rise Time	tICr		-	-	5	μs
Input Clock Fall Time1	tICf		-		5	μs
Output Rise Time ¹	tr	15pF load, 0.8 to 2.0V	-	1.5	2	ns
Rise Time ¹	tf	15pF load, 20% to 80% VDD	-	2.5	4	ns
Output Fall Time ¹	tf	15pF load, 2.0 to 0.8V	•	1.5	2	ns
Fall Time ^I	tf	15pF load, 80% to 20% VDD	-	2.5	4	ns
Duty Cycle ¹	dŧ	15pF load @ Vt=1.4V	43/57	48/52	57/43	%
Duty Cycle, reference	d _t	15pF load @ 1.4V ²	40/60	43/57	60/40	%
clocks ¹						
Jitter, One Sigma ¹	1	As compared with clock period.	-	1	3	%
Jitter, Absolute ^l	tjab]	-	2	5	%
Input Frequency ¹	fi		25	32.768	40	kHz
Clock Skew between any	Tsk		-	100	500	ps
Clock #2 outputs1	1]				-
Power-up Time ¹	tpu	From off to 40 MHz	-	1,000	-	ms

Note: 1. Parameter is guaranteed by design and characterization. Not 100% tested in production.

4

4825758 0002731 312 **=**

^{2. 32} kHz output duty cycle is dependent on crystal used.



Electrical Characteristics at 5V

 V_{DD} = +5.0V ±10%; T_A =0°C to 70°C unless otherwise stated

		DC Characteristics				
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	ТҮР	MAX	UNITS
Input Low Voltage	VIL		-	-	0.2Vpp	v
Input High Voltage	Vih		0.7V _{DD}	-		v
Input Low Current	ħr.	VIN=0V (Pull-up)	-15	-		μА
Input High Current	Іін	V _{IN} =V _{DD}	-2	_	2	μА
Output Low Voltage ¹	Vol	IoL=4mA	-	-	0.1	V
Output High Voltage ¹	Voн	Iон=-1mA	V _{ID} .1V			v
Output High Voltage ¹	Voн	IOH=-4mA	-			v
Output High Voltage ¹	Voн	IOH=-8mA	2.4	-	_	v
Output Frequency Change over Supply and Temperature ¹	FD	With respect to typical frequency ¹	-	.005	0.05	%
Short Circuit Current ¹	Isc	Each output clock	-	33	-	mA
Supply Current	IDD	No load, 40 MHz	-	17	_	mA
ViD32 Supply Current	IDD 32	No load, VDD32=5.5V	-	7.5	20	μА
Vm32 Supply Voltage	V _{DD} 32	VDD=0 to 5.5V, 32 kHz output operating	2.0	-	-	v
Pull-up Resistor Value	Rpu		•	380		k½
		AC Characteristics		L- ,,.		
Input Clock Rise Time ¹	tICr		-		5	μs
Input Clock Fall Time ¹	tiCf		-	_	5	μs
Output Rise Time ^l	tr	15pF load, 0.8 to 2.0V	•	1	1.5	ns
Rise Time ¹	tr	15pF load, 20% to 80% VDD	-	2	3	ns
Output Fall Time ^l	tf	15pF load, 2.0 to 0.8V	-	1	1.5	ns
Fall Time ¹	tf	15pF load, 80% to 20% VDD	-	2	3	ns
Duty Cycle ¹	d t	15pF load @ Vth=1.4V	43/57	48/52	57/43	%
Duty Cycle, reference clocks ¹	d t	15pF load @ 1.4V ²	40/60	43/57	60/40	%
Jitter, One Sigma ^l	tjls		-	1	3	%
litter, Absolute ^l	tjab	As compared with clock period.	-	2	5	%
Input Frequency ¹	fi		25	32.768	40	kHz
Clock Skew between any Clock #2 outputs ¹	Tsk		-	100	500	ps
Power-up Time ¹	tpu	From off to 40 MHz		10	_	ms

Note: 1. Parameter is guaranteed by design and characterization. Not 100% tested in production.

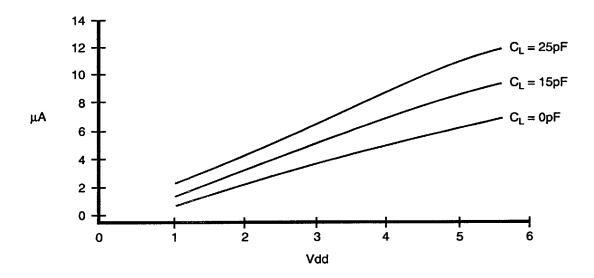
5

^{2. 32} kHz output duty cycle is dependent on crystal used.

ICS9133X



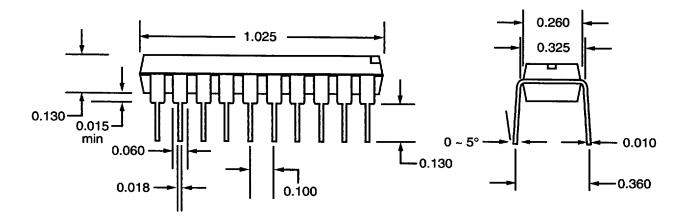
Typical 32 kHz Supply Current



6



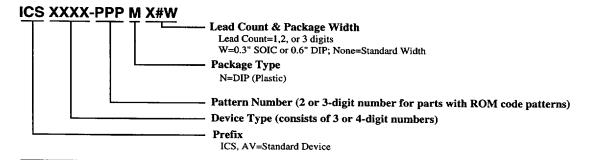
Package Information



20-Pin DIP Package

Ordering Information

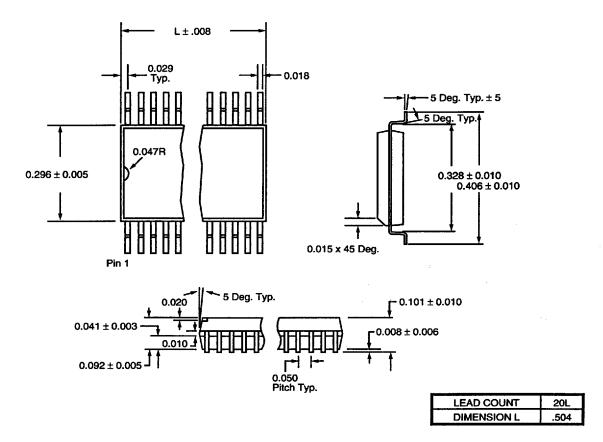
Example:



7

4825758 0002734 021 🗯

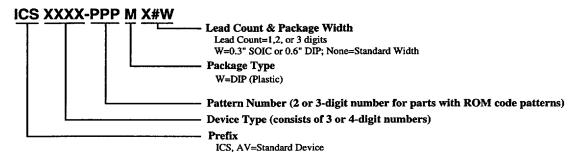




SOIC Packages (Widebody)

Ordering Information ICS9133X-01CW20

Example:



ICS reserves the right to make changes in the device data identified in this publica tion without further notice. ICS advises its customers to obtain the latest version of all device data to verify that any information being relied upon by the customer is current and accurate.

💻 4825758 0002735 T68 🖿

8