National Semiconductor
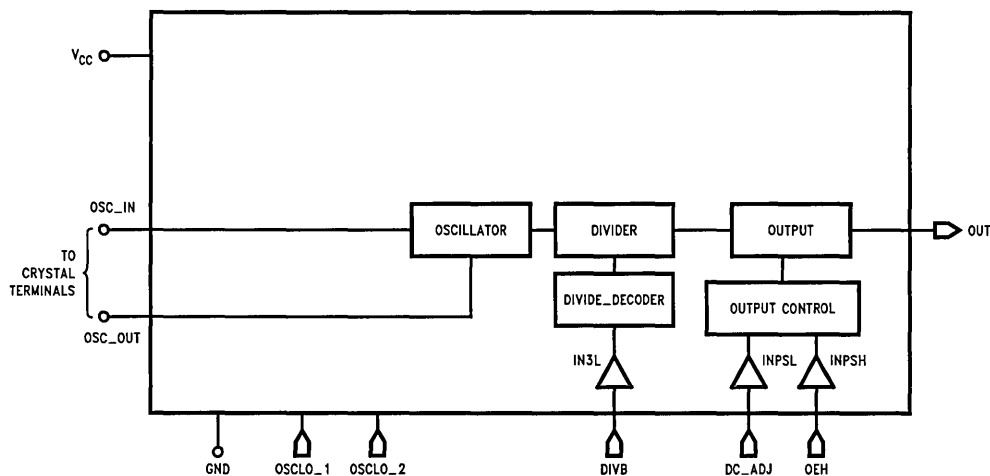
CGS3321/CGS3322
CMOS Crystal Clock Generators

General Description

These devices are designed for Clock Generation and Support (CGS™) applications up to 110 MHz. The CGS332x series of devices are crystal controlled CMOS oscillators requiring a minimum of external ccomponents. The 332x devices provide selectable output divide ratio. The circuit is designed to operate over a wide frequency range using fundamental mode or overtone crystals.

Features

■ National's CGS family of devices for high frequency clock source applications

■ Crystal frequency operation range:
  fundamental: 10 MHz to 110 MHz typical
  3rd or 5th overtone: 10 MHz to 95 MHz
■ 1000V ESD protection on OSC_IN and OSC_OUT pins. 2000V ESD protection on all other pins
■ Output current drive of 48 mA for I_{OL}/I_{OH}
■ FACT™ CMOS output levels
■ Output has high speed short circuit protection
■ Intended for Pierce oscillator applications
■ Hysteresis inputs to improve noise margin
■ CGS3321 has duty cycle adjust
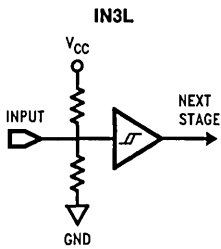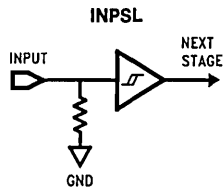■ CGS3322 has 1, 2, 4 divide ratio

Block Diagrams

Note: Pin numbers vary for each device.

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Block Diagrams (Continued)

Input Drivers

IN3L

INPUT

V_CC

NEXT STAGE

GND

TL/F/11503-2

INPSL

INPUT

NEXT STAGE

GND

TL/F/11503-3

INPSH

V_CC

INPUT

NEXT STAGE
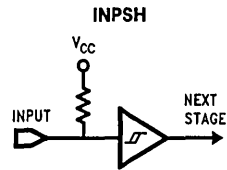
TL/F/11503-4

Oscillator Stage

100 kΩ

OSC_IN

4 pF

GND

OSC_OUT

TO DIVIDE STAGE

TL/F/11503-5

Output Stage

FROM DIVIDER STAGE

OUTPUT SYMMETRY CIRCUITRY

OUTPUT BUFFER

V_CC

OUT

OUTPUT CONTROL CIRCUITRY

TL/F/11503-6

DC_ADJ

OSC_LO

TL/F/11503-9

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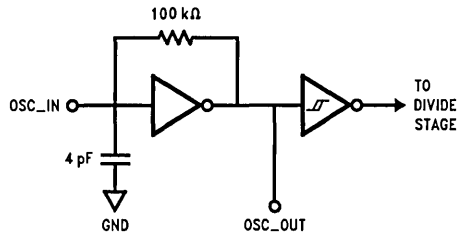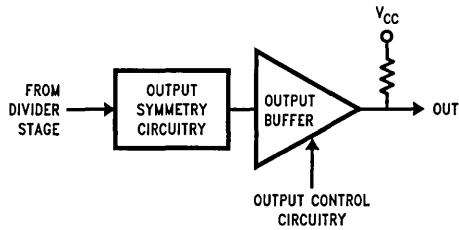
Pin Descriptions

OSC_IN — Input to Oscillator Inverter. The output of the crystal would be connected here.
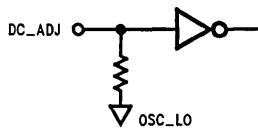
OSC_OUT — Buffered Output of the Oscillator Inverter

DIVB — (CGS3322 only)
3-Level input used to select Binary Divide-by value of output frequency.

DC_ADJ — (CGS3321 only)
Active high input that controls output duty cycle. Logic high level will delay the HL transition edge approximately 0.3 ns.

Note: Pin out varies for each device.

OEH — Active High TRI-STATE® enable pin. This pin pulls to a high value when left floating and TRI-STATEs the output when forced low. This pin has TTL compatible input levels.

OUT — This pin is the main clock output on the device.

OSCLO_1 — The Oscillator Low pin is the ground for the Oscillator.

V_{CC} — The power pin for the chip.

GND — The ground pin for all sections of the circuitry except the oscillator and oscillator related circuitry.

Connection Diagrams

Pin Assignment for SOIC

3321

OSC_OUT — 1		8 — OSC_IN
OEH — 2		7 — DC_ADJ
OSLO_1 — 3		6 — V_{CC}
GND — 4		5 — OUT

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3322

OSC_OUT — 1		8 — OSC_IN
OEH — 2		7 — DIVB
OSCLO_1 — 3		6 — V_{CC}
GND — 4		5 — OUT
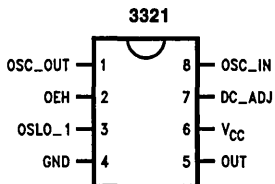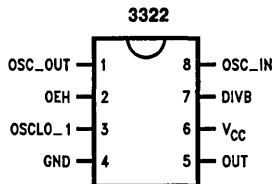
TL/F/11503-8

Truth Table

Division Selection

DIVB	OEH	Divider Output
F	X	Divide-by 1
1	1	Divide-by 2
0	1	Divide-by 4

Note: Actual value of the floating DIVB input is $V_{CC/2}$.

Absolute Maximum Ratings (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC})	$-0.5V$ to $7.0V$
DC Input Voltage Diode Current (I_{IK})	± 9 mA
DC Input Voltage (V_I)	$-0.5V$ to $7.0V$
DC Output Diode Current (I_{OK})	± 20 mA
DC Output Voltage (V_O)	$-0.5V$ to $V_{CC} + 0.5V$
DC Output Source or Sink Current (I_O)	± 70 mA
Storage Temperature (T_{STG})	$-55°C$ to $+150°C$
Junction Temperature (T_J) SOIC	$140°C/W$

Recommended Operating Conditions

Supply Voltage (V_{CC})	4.5V to 5.5V
Input Voltage (V_I)	0V to 5.5V
Output Voltage (V_O)	0V to V_{CC} V
Operating Temperature (T_A)	$-40°C$ to $+85°C$

Note: *The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the DC and AC Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The Recommended Operating Conditions will define the conditions for actual device operation.*

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$ Typ	$T_A = +25°C$ Min	$T_A = +25°C$ Max	$T_A = -40°C$ to $+85°C$ Min	$T_A = -40°C$ to $+85°C$ Max	$T_A = -55°C$ to $+125°C$ Min	$T_A = -55°C$ to $+125°C$ Max	Units	Conditions
$V_{IH_{TTL}}$	Minimum High Level Input Voltage. TTL Level Inputs (OEH, OEL)	4.5 5.5		2.0 2.0		2.0 2.0				V	
$V_{IL_{TTL}}$	Maximum Low Level Input Voltage. TTL Level Inputs (OEH, OEL)	4.5 5.5			0.8 0.8		0.8 0.8			V	
$V_{IH_{CMOS}}$	Minimum High Level Input Voltage. CMOS Level Inputs (DC__ADJ)	4.5 5.5		3.15 3.85		3.15 3.85				V	
$V_{IL_{CMOS}}$	Maximum Low Level Input Voltage. CMOS Level Inputs (DC__ADJ)	4.5 5.5			1.35 1.65		1.35 1.65			V	
V_{IN3L_H}	Minimum Logic 1 Input for Three Level Input (DIVB)	4.5 5.5		4.05 4.95		4.05 4.95				V	
$V_{IN3L\_1/2}$	Minimum Logic 1/2 Input for Three Level Input (DIVB)	4.5 5.5		1.8 2.2	2.7 3.3	1.8 2.2	2.7 3.3			V	
V_{IN3L_L}	Maximum Logic 0 Input Level Three Level Input (DIVB)	4.5 5.5			0.45 0.45		0.45 0.45			V	
V_{OH}	Minimum High Level Output Voltage	4.5 5.5	4.49 5.49	4.40 5.40		4.40 5.40				V	$I_{OUT} = -50\ \mu A$
		4.5 5.5		3.86 4.86		3.76 4.76					$I_{OH} = -48$ mA $V_{IN} = V_{IH}$ or V_{IL}

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DC Electrical Characteristics (Continued)

Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$ Typ	$T_A = +25°C$ Min	$T_A = +25°C$ Max	$T_A = -40°C$ to $+85°C$ Min	$T_A = -40°C$ to $+85°C$ Max	$T_A = -55°C$ to $+125°C$ Min	$T_A = -55°C$ to $+125°C$ Max	Units	Conditions
						Guaranteed Limits					
V_{OL}	Minimum Low Level Output Voltage	4.5	0.001		0.1		0.1			V	$I_{OUT} = 50 \mu A$
		5.5	0.001		0.1		0.1				
		4.5			0.44		0.44				$I_{OL} = +48$ mA $V_{IN} = V_{IL}$ or V_{IH}
		5.5			0.44		0.44				
I_{IHRES}	Input Current for Pins DIVB	5.5		220	360	200	380			μA	$V_{IN} = 5.5V$
I_{ILRES}	Input Current for Pins DIVB	5.5		−220	−360	−200	−380			μA	$V_{IN} = 0.0V$
I_{IHENAB}	Input Current for Enable Pin OEL	5.5		90	160	85	175			μA	$V_{IN} = 5.5V$
I_{ILENAB}	Input Current for Enable pin OEH	5.5		−90	−160	−85	−175			μA	$V_{IN} = 0.0V$
I_{IHOSC}	Input Current for OSC__IN pin (Indicates Bias Resistance)	5.5		20	100	20	125			μA	$V_{IN} = 5.5V$
I_{ILOSC}	Input Current for OSC__IN pin (Indicates Bias Resistance)	5.5		−20	−100	−20	−125			μA	$V_{IN} = 0.0V$
I_{OZH}	Output Disabled Current (Output High)	4.5			3.0		5.0			μA	$V_{OUT} = V_{CC}$
		5.5			3.0		5.0				
I_{OZL}	Output Disabled Current (Output Low)	4.5			−140		−150			μA	$V_{OUT} = 0.0V$
		5.5			−170		−180				
I_{OLD}	Minimum Dynamic Output Current	5.5		75		75				mA	$V_{OLD} = 1.65V$
I_{OHD}	Minimum Dynamic Output Current	5.5		−75		−75				mA	$V_{OHD} = 3.85V$
I_{CCT}	Additional Maximum I_{CC} per Input (OEH, OEL Pins)	5.5			1.5		1.5			mA	$V_{IN} = V_{CC} - 2.1V$
I_{CC3L}	Additional Maximum I_{CC} per Input (DIVB)	5.5			1.5		1.5			mA	DIVB Inputs Equal to $V_{CC/2}$

AC Electrical Characteristics

Over recommended operating free air temperature range. All typical values are measured at V_{CC} = 5V, T_A = 25°C

Symbol	Parameter	V_{CC}* (V)	CGS332X						Units
			T_A = −40°C to +85°C C_L = 50 pF			T_A = −55°C to +125°C C_L = 50 pF			
			Min	Typ	Max	Min	Typ	Max	
f_{MAX}	Frequency Maximum	5.0	95	110					MHz
t_{PZH}	Output High Enable Time	5.0	1.0		31.5				ns
t_{PZL}	Output Low Enable Time	5.0	1.0		28.0				ns
t_{PHZ}	Output High Disable Time	5.0	1.0		21.5				ns
t_{PLZ}	Output Low Disable Time	5.0	1.0		16.0				ns
t_{rise}, t_{fall}	Rise/Fall Time (30 pF, 20% to 80%)	5.0		1.0					ns

*Voltage Range 5.0 is 5.0V ± 0.5V.

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