

2-36MHZ PROGRAMMABLE, LOW-POWER CRYSTAL OSCILLATOR CORE

FEATURES

- ✓ **Low power operation**
 - **Controlled crystal power dissipation**
 - **Controlled amplitude for low on-chip power dissipation**
- ✓ **Low noise operation**
 - **Excellent supply noise rejection**
 - **Low self-generated noise**
- ✓ **Programmable operational frequency**
 - **Wide range: 2 - 36 MHz**
- ✓ **Typical off-chip components**
 - **Input/Output load capacitor**
 - **Crystal resonator**
- ✓ **Capable of safely driving 100mW crystals**
- ✓ **Overtone operation for >30MHz application**
- ✓ **Bypass mode for test and single-ended operation**
- ✓ **Differential Receive mode**
- ✓ **Complete HBM and CDM ESD protection**

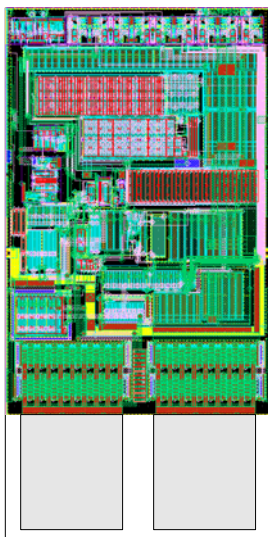


Figure 1. Core illustrated with 70µ pitch

AVAILABILITY

Initially designed in TSMC's 0.18µ process, the OSC0236LP oscillator core is currently available in the following form factors:

- **140µ X 220µ for in-line 70µ pitch**
- **80µ X 360µ for staggered 40µ pitch**

The core lends itself to easy migration to other processes and foundries. Utilization of thick-gate transistors for the majority of the oscillator core circuitry minimizes process-specific performance impacts when migrating.

Contact Greyrock Technology for OSC0236LP use in the process and foundry you need.

info@greyrocktech.com

US phone 970-204-9182

SUPPORT

The OSC0236LP is delivered with the following components necessary for ASIC design and physical integration:

- **Expanded Data Sheet**
- **Theory of Operation**
- **Integration Application Note**
- **Operational Application Note**
- **Test Plan**
- **GDSII Physical Data Base**
- **Routing Files**
- **Physical Verification Files**
- **Synopsis Timing Files**
- **Verilog Function Model**

Additional services available from Greyrock Technology:

- **Operational Application Consulting**
- **Integration Consulting**
- **Characterization Consulting**
- **Quartz Crystal Models**
 - **Single Frequency and Parameterized**
- **Oscillator Board Layout Consulting**

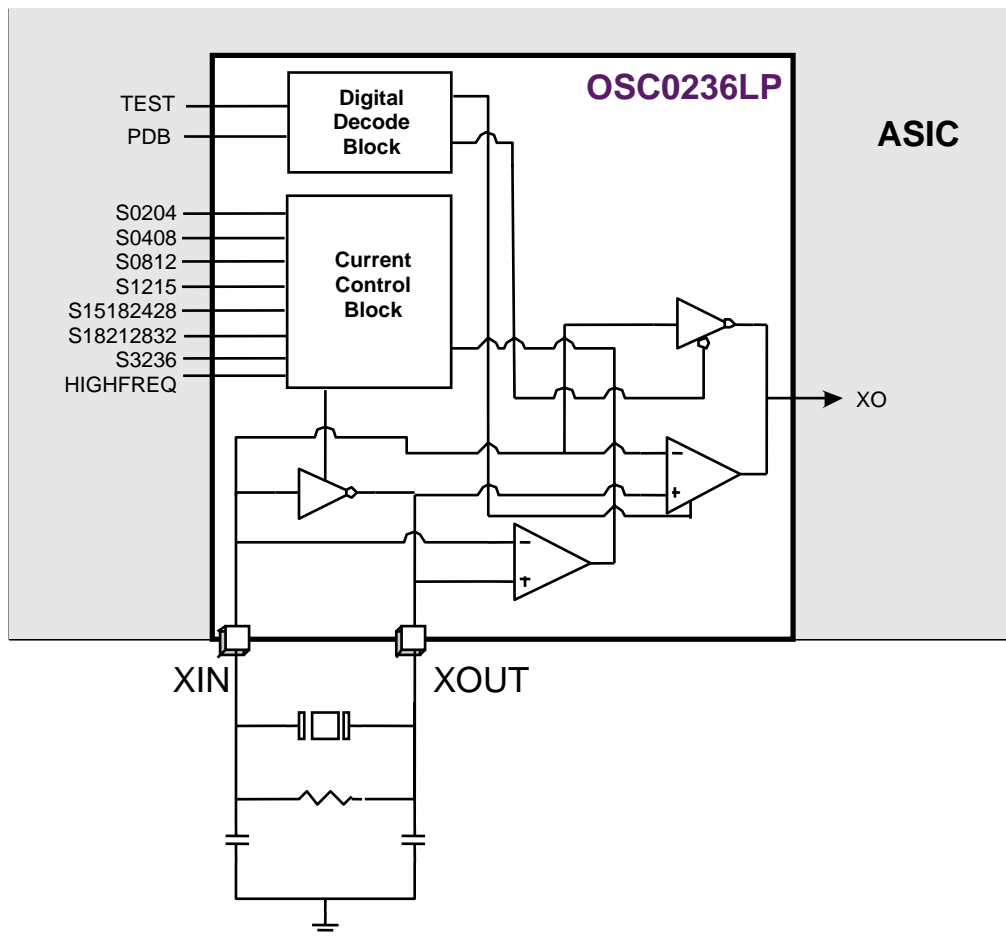
DESCRIPTION

The Greyrock Technology OSC0236LP is a programmable crystal oscillator core spanning an operational range of 2MHz to 36MHz. The core employs an amplitude control loop that limits the power dissipation in the crystal itself allowing operation with today's low-power-dissipation quartz crystals. In addition to the low power drive capability, the on-chip power dissipation of the core is also limited.

The OSC0236LP has multiple operational modes for optimizing system performance and ease of testing. The differential-input mode allows external oscillators or clock distribution devices to be connected directly to the oscillator core without damage or excess power dissipation. The single-ended, bypass mode allows single-ended CMOS clocks, either 1.8V, 2.5V or 3.3V levels, to drive the oscillator core directly without damage or excess power dissipation. In addition, the single-ended, bypass mode provides a convenient method of driving a higher-speed test clock to an IC's internal circuitry without having to pass through the oscillator core.

The OSC0236LP can function as both a fundamental mode oscillator and an overtone oscillator. Fundamental mode quartz resonators are readily available up to 27MHz. Higher frequencies can be achieved using an overtone oscillator with off-chip tuning circuitry.

BLOCK DIAGRAM



Specifications subject to change without notice.

I/O DESCRIPTION																																																																				
Pin Name	I/O Type	Drive Levels	Description																																																																	
Power / Ground																																																																				
VDDIO	Power	3.3V / 2.5V	I/O power supply, typically placed next to Xtal Core, 2.5V or 3.3V																																																																	
VSSIO	Ground	0V	I/O ground reference/return, 0V																																																																	
VDD	Substrate	1.8V / 1.2V	IC Core power supply, 1.8V in 0.18μ or 1.2V in 0.13μ																																																																	
VSS	Ground	0V	IC Core ground reference/return, 0V																																																																	
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XIN	Input	Analog	Crystal Resonator Core input, high Z, ESD protected																																																																	
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XO	Output	Core CMOS	Core Output, level-shifted and buffered digital output signal to the IC core.																																																																	

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DC ELECTRICAL OPERATING SPECIFICATION					
Parameter	Unit	Min	Typ	Max	Conditions
VDDIO	V	2.97	3.3	3.63	I/O power supply, typically placed next to Xtal Core VDDIO = 2.5V, range +/- 10% also applicable
VDD	V	1.62	1.8	1.98	Using 0.18 μ .
	V	1.08	1.2	1.32	Using 0.13 μ .
Die temperature	$^{\circ}$ C	0	25	125	
Supply Current – Startup nominal VDDIO	μ A		170 210 290 360 410 470 520 720 820 930 1040		0MHz – 2MHz Operation Selected 2MHz – 4MHz Operation Selected 4MHz – 8MHz Operation Selected 8MHz – 12MHz Operation Selected 12MHz – 15MHz Operation Selected 15MHz – 18MHz Operation Selected 18MHz – 21MHz Operation Selected 20MHz – 24MHz Operation Selected 24MHz – 28MHz Operation Selected 28MHz – 32MHz Operation Selected 32MHz – 36MHz Operation Selected
Supply Current – Operational nominal VDDIO	μ A		170 180 200 210 250 260 280		0MHz – 2MHz Operation Selected 2MHz – 4MHz Operation Selected 4MHz – 8MHz Operation Selected 8MHz – 12MHz Operation Selected 12MHz – 15MHz Operation Selected 15MHz – 18MHz Operation Selected 18MHz – 21MHz Operation Selected
Supply Current	μ A		1.0		Powered Down.
Input Thresholds – Digital Core Side	% VDD	40	50	60	Core-side digital input threshold levels.
Input Threshold – XIN	% VDD33	40	50	60	Input threshold when core is operating in Test or Bypass mode.
Differential Input Threshold	V _{PPDIF}	0.8V	1.0	2	Differential input threshold when operating in Differential Mode.
Differential Input Common Mode Range	V	0.25	0.75	1.2	Differential input common mode voltage when operating in Differential Mode.

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AC ELECTRICAL OPERATING SPECIFICATION					
Parameter	Unit	Min	Typ	Max	Conditions
Cycle-to-Cycle Jitter – I/O Supply	ps/mV			0.5	As a result of noise on either VDD33 or VSS33 or between VDD33 and VSS33. DC to 100kHz noise frequency range. 1mV _{PP} to 100mV _{PP} Noise Voltage Range.
Cycle-to-Cycle Jitter – I/O Supply	ps/mV			0.3	As a result of noise on either VDD33 or VSS33 or between VDD33 and VSS33. DC to 100kHz noise frequency range. 1mV _{PP} to 100mV _{PP} Noise Voltage Range.
Oscillation Amplitude, XOUT-XIN	mV _{PPDIF}		900		Differential peak-to-peak amplitude across the crystal resonator during operation.
Start-up Time	mSec		2		@27MHz with typical quartz crystal resonator.
Input/Output Capacitance	pF		3.5		Capacitance added by the oscillator core. This capacitance is in parallel with any load capacitance and must be considered when determining the desired load capacitance.
Differential Input Duty Cycle	%	45	50	55	Differential input duty cycle required to meet output characteristics.
XIN-to-XO Propagation Time	nSec		1.5		50% of I/O voltage to 50% of IC core voltage.
Differential Input-to-XO Propagation Time	nSec		1.5		Zero Voltage Differential crossing to 50% of IC core voltage.
XO Duty Cycle, all modes	%	40	50	60	All operational modes, Cload < 40fF.
Startup Phase Margin	°	50	70	80	Over operating frequency range. Highly dependent on the quartz crystal resonator's characteristics.
Startup Gain Margin	dB	3	10		Over operating frequency range. Highly dependent on the quartz crystal resonator's characteristics.

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