

## Features

- Fully compliant SEC (G.813) and EEC (G.8262) flexible rate conversion digital phase locked loop (DPLL)
- Programmable DPLL/Numerically Controlled Oscillators (NCO)
- Synchronizes to any clock rate from 1 Hz to 750 MHz
- Three programmable synthesizers generate any clock rate from 1 Hz to 750 MHz with maximum jitter below 0.62 ps rms
- Flexible two-stage architecture translates between arbitrary data rates, line coding rates and FEC rates
- Digital PLL filters jitter from 0.1 mHz up to 1 kHz
- Automatic hitless reference switching and digital holdover on reference fail
- Nine input references configurable as single ended or differential and two single ended input references

## Ordering Information

ZL30161GDG2    144 Pin LPGA    Trays

Pb Free Tin/Silver/Copper

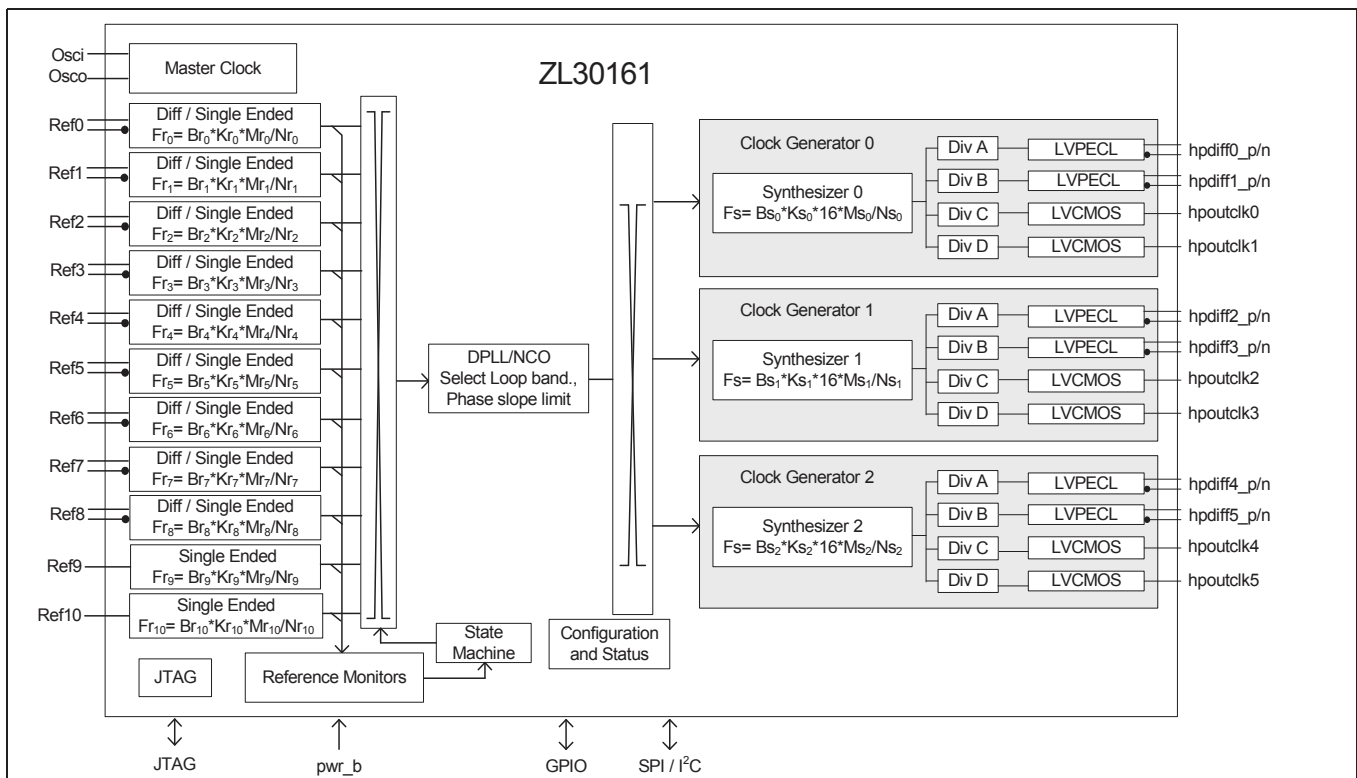
**-40°C to +85°C**

Package Size: 13 x 13 mm

- Any input reference can be fed with sync (frame pulse) or clock
- Programmable DPLL can synchronize to sync pulse and sync/clock pair.
- Six LVPECL outputs and six LVCMOS outputs
- Operates from a single crystal resonator or clock oscillator
- Field programmable via SPI/I<sup>2</sup>C interface

## Applications

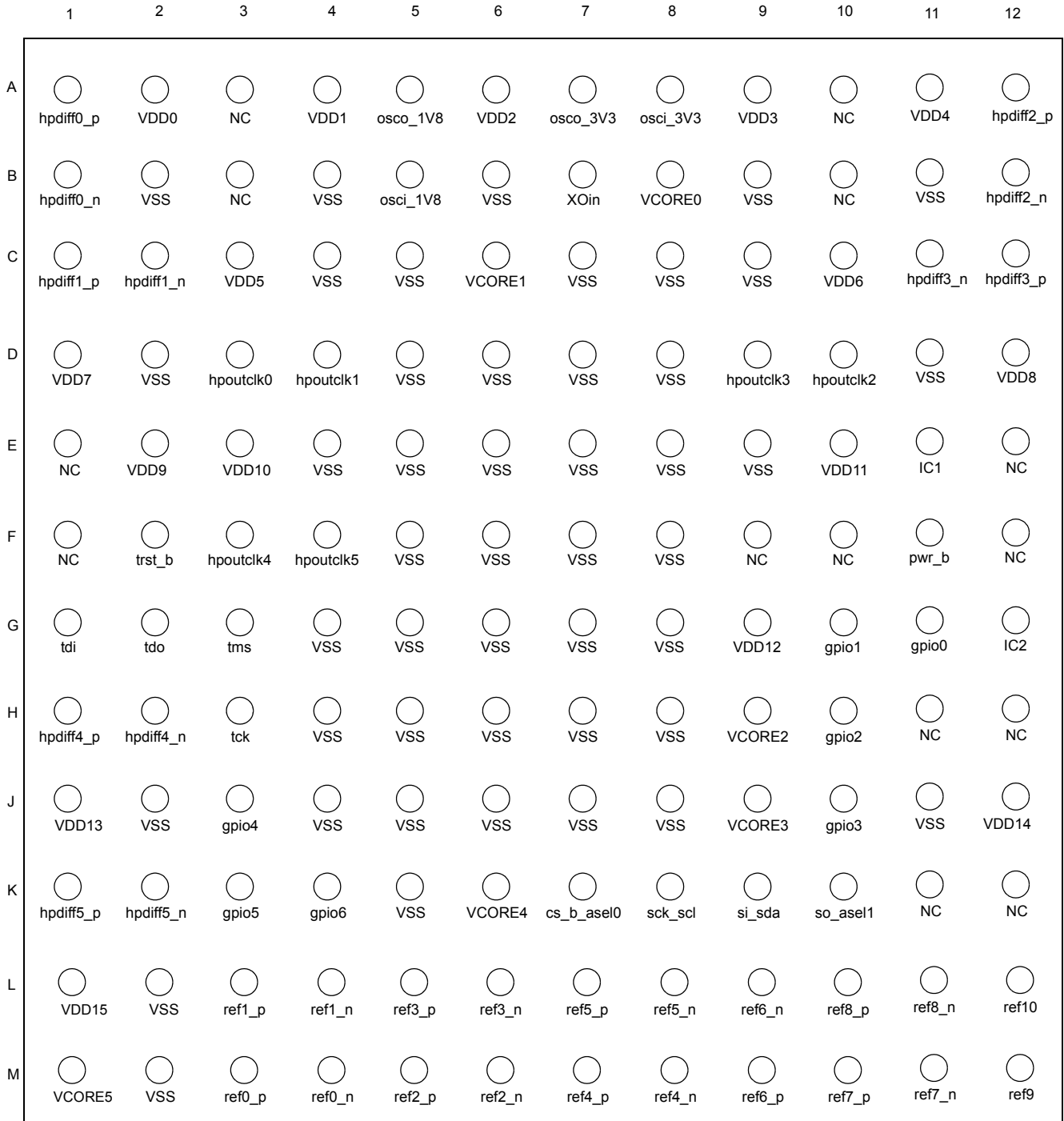
- SyncE/SONET/SDH Timing Cards
- Synchronous Ethernet, 10 GBASE-R and 10 GBASE-W
- SONET/SDH, Fibre Channel, XAUI



**Figure 1 - Functional Block Diagram**

## 1.0 Pin Diagram

### TOP VIEW



 - A1 corner is identified by metallized markings.

**Figure 2 - Pin Diagram**

## 2.0 Pin Description

All device inputs and outputs are LVCMOS unless it is specifically stated to be differential. For the I/O column, there are digital inputs (I), digital outputs (O), analog inputs (A-I) and analog outputs (A-O).

Ball #	Name	I/O	Description
<b>Input Reference</b>			
M3 M4 L3 L4 M5 M6 L5 L6 M7 M8 L7 L8 M9 L9 M10 M11 L10 L11	ref0_p ref0_n ref1_p ref1_n ref2_p ref2_n ref3_p ref3_n ref4_p ref4_n ref5_p ref5_n ref6_p ref6_n ref7_p ref7_n ref8_p ref8_n	I	<p><b>Input References 0 to 8.</b> Input reference sources used for synchronization. The positive and negative pair of these inputs accepts a differential input signal. The refx_p input terminal accepts a CMOS input reference. These inputs can be used as an external feedback input.</p> <p>Maximum frequency limit on single ended inputs is 177.5 MHz, and 750 MHz on differential inputs.</p>
M12 L12	ref9 ref10	I	<p><b>Input References 9 and 10.</b> Input reference sources used for synchronization. These inputs are the same as inputs 0 to 8, but only single ended. These inputs can be used as an external feedback input.</p> <p>Maximum frequency limit is 177.5 MHz</p>
<b>Output Clocks</b>			
D3 D4 D10 D9 F3 F4	hpoutclk0 hpoutclk1 hpoutclk2 hpoutclk3 hpoutclk4 hpoutclk5	O	<p><b>High Performance Output Clocks 0 to 5.</b> These outputs can be configured to provide any one of the single ended high performance clock outputs.</p> <p>Maximum frequency limit on single ended LVCMOS outputs is 177.5 MHz.</p>
A1 B1 C1 C2 A12 B12 C12 C11 H1 H2 K1 K2	hpdiff0_p hpdiff0_n hpdiff1_p hpdiff1_n hpdiff2_p hpdiff2_n hpdiff3_p hpdiff3_n hpdiff4_p hpdiff4_n hpdiff5_p hpdiff5_n	O	<p><b>High Performance Differential Output Clocks 0 to 5 (LVPECL).</b> These outputs can be configured to provide any one of the available high performance differential output clocks.</p> <p>Maximum frequency limit on differential outputs is 750 MHz.</p>

**Table 1 - Pin Description**

Ball #	Name	I/O	Description
<b>Control and Status</b>			
F11	pwr_b	I	<b>Power-on Reset.</b> A logic low at this input resets the device. To ensure proper operation, the device must be reset after power-up. The <b>pwr_b</b> pin should be held low for 2 ms after all power supplies are stabilized. This pin is internally pulled-up to $V_{DD}$ . User can access device registers either 125 ms after <b>pwr_b</b> goes high, or after bit 7 in register at address 0x000 goes high (which can be determined by polling).
G11 G10 H10 J10 J3 K3 K4	gpio0 gpio1 gpio2 gpio3 gpio4 gpio5 gpio6	I/O	<p><b>General Purpose Input and Output pins.</b> These are general purpose I/O pins.</p> <p>Example GPIO functions include:</p> <ul style="list-style-type: none"> <li>• DPLL lock indicators</li> <li>• DPLL holdover indicators</li> <li>• Reference fail indicators</li> <li>• Reference select control or monitor</li> <li>• Differential output clock enable</li> <li>• High performance LVCMOS outputs enable</li> <li>• Host Interrupt Output to flag status changes.</li> </ul> <p>All GPIO functions are listed in section 5.2, "GPIO Configuration".</p> <p>Pins 5:0 are internally pulled down to GND and pin 6 is internally pulled up to <math>V_{DD}</math>.</p> <p>Unused GPIO pins can be left unconnected.</p> <p><b>After power on reset, device GPIO[0,1,3,4] configure basic device function. GPIO3 sets I<sup>2</sup>C or SPI control mode, GPIO[1,0] sets master clock rate selection. The GPIO[0,1,3] pins must be either pulled low or high with an external 1 kohms resistor for their assigned functions at reset; or they must be driven low or high for 125 ms after reset, and released and then used for normal GPIO functions.</b></p> <p><b>The GPIO4 pin must be either pulled low with an external 1 kohms resistor; or it must be driven low for 125 ms after reset, and then released and used for normal GPIO functions.</b></p> <p><b>GPIO[5,6] are not used during power up.</b></p>
<b>Host Interface</b>			
K8	sck_scl	I/O	<b>Clock for Serial Interface.</b> Provides clock for serial micro-port interface. This pin is also the serial clock line (SCL) when the host interface is configured for I <sup>2</sup> C mode. As an input this pin is internally pulled up to $V_{DD}$ .
K9	si_sda	I/O	<b>Serial Interface Input.</b> The serial data stream holds the access command, the address and the write data bits. This pin is also the serial data line (SDA) when host interface is configured for I <sup>2</sup> C mode. This pin is internally pulled up to $V_{DD}$ .
K10	so_ase1	I/O	<b>Serial Interface Output.</b> As an output, the serial stream holds the read data bits. This pin is also the I <sup>2</sup> C address select when host interface is configured for I <sup>2</sup> C mode.

**Table 1 - Pin Description (continued)**

Ball #	Name	I/O	Description
K7	cs_b_ase10	I	<b>Chip Select for Serial Interface.</b> Serial interface chip select, this is an active low signal. This pin is also the I <sup>2</sup> C address select when host interface is configured for I <sup>2</sup> C mode. This pin is internally pulled up to V <sub>DD</sub> .
<b>JTAG (IEEE 1149.1) and Test</b>			
G12	IC2	I	<b>Internal Connection.</b> Connect this pin to GND.
E11	IC1	A-I/O	<b>Internal Connection.</b> Leave unconnected.
G2	tdo	O	<b>Test Serial Data Out.</b> JTAG serial data is output on this pin on the falling edge of tck. This pin is held in high impedance state when JTAG scan is not enabled.
G1	tdi	I	<b>Test Serial Data In.</b> JTAG serial test instructions and data are shifted in on this pin. This pin is internally pulled up to V <sub>DD</sub> . If this pin is not used then it should be left unconnected.
F2	trst_b	I	<b>Test Reset.</b> Asynchronously initializes the JTAG TAP controller by putting it in the Test-Logic-Reset state. This pin should be held low or pulsed low on power-up to ensure that the device is in the normal functional state. This pin is internally pulled up to V <sub>DD</sub> . If this pin is not used then it should be connected to GND.
H3	tck	I	<b>Test Clock.</b> Provides the clock for the JTAG test logic. This pin is internally pulled up to V <sub>DD</sub> . If this pin is not used then it should be connected to GND.
G3	tms	I	<b>Test Mode Select.</b> JTAG signal that controls the state transitions of the TAP controller. This pin is internally pulled up to V <sub>DD</sub> . If this pin is not used then it should be left unconnected.
<b>Master Clock</b>			
Note: The <b>osci_1V8/osco_1V8</b> pins are preferred to connect a crystal to the device. The <b>XOin</b> pin is preferred to connect a crystal oscillator (XO) to the device.			
A7	osco_3V3	A-O	<b>3.3V Crystal Master Clock Output.</b> For the alternative connection method for a crystal, the crystal is connected from this pin to <b>osci_3V3</b> . Not suitable for driving other devices. For clock oscillator operation or the use of a crystal between <b>osci_1V8</b> and <b>osco_1V8</b> , this pin should be left unconnected.
A8	osci_3V3	I	<b>3.3V Crystal Master Clock Input.</b> For the alternative connection method for a crystal, the crystal is connected from this pin to <b>osco_3V3</b> . For clock oscillator operation or the use of a crystal between <b>osci_1V8</b> and <b>osco_1V8</b> , this pin should be grounded.
A5	osco_1V8	A-O	<b>1.8V Crystal Master Clock Output.</b> For the primary connection method for a crystal, the crystal is connected from this pin to <b>osci_1V8</b> . Not suitable for driving other devices. For clock oscillator operation or the use of a crystal between <b>osci_3V3</b> and <b>osco_3V3</b> , this pin should be left unconnected.
B5	osci_1V8	I	<b>1.8V Crystal Master Clock Input.</b> For the primary connection method for a crystal, the crystal is connected from this pin to <b>osco_1V8</b> . For clock oscillator operation or the use of a crystal between <b>osci_3V3</b> and <b>osco_3V3</b> , this pin should be grounded.

Table 1 - Pin Description (continued)

Ball #	Name	I/O	Description
B7	XOin	I	<b>XO Master Clock Output.</b> For clock oscillator operation, this pin is connected to the output of the oscillator. For crystal operation using either method, this pin should be grounded.
<b>Power and Ground</b>			
B8 C6 H9 J9 K6 M1	V <sub>CORE0</sub> V <sub>CORE1</sub> V <sub>CORE2</sub> V <sub>CORE3</sub> V <sub>CORE4</sub> V <sub>CORE5</sub>		<b>Positive Supply Voltage.</b> +1.8V <sub>DC</sub> nominal.  These pins should not be connected together on the board. Please refer to ZLAN-327 for recommendations
A2 A4 A6 A9 A11 C3 C10 D1 D12 E2 E3 E10 G9 J1 J12 L1	V <sub>DD0</sub> V <sub>DD1</sub> V <sub>DD2</sub> V <sub>DD3</sub> V <sub>DD4</sub> V <sub>DD5</sub> V <sub>DD6</sub> V <sub>DD7</sub> V <sub>DD8</sub> V <sub>DD9</sub> V <sub>DD10</sub> V <sub>DD11</sub> V <sub>DD12</sub> V <sub>DD13</sub> V <sub>DD14</sub> V <sub>DD15</sub>		<b>Positive Supply Voltage.</b> +3.3V <sub>DC</sub> nominal.  These pins should not be connected together on the board. Please refer to ZLAN-327 for recommendations

**Table 1 - Pin Description (continued)**

Ball #	Name	I/O	Description
B2	V <sub>SS</sub>		<b>Ground. 0 Volts.</b>
B4			
B6			
B9			
B11			
C4			
C5			
C7			
C8			
C9			
D2			
D11			
E4			
E9			
G4			
H4			
H5			
H6			
H7			
H8			
J2			
J4			
J5			
J6			
J7			
J8			
J11			
K5			
L2			
M2			
D5			
D6			
D7			
D8			
E5			
E6			
E7			
E8			
F5			
F6			
F7			
F8			
G5			
G6			
G7			
G8			

**Table 1 - Pin Description (continued)**

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Ball #	Name	I/O	Description
A3 A10 B3 B10 E1 E12 F1 F9 F10 F12 H11 H12 K12 K11	NC		<b>No Connect.</b> These pins should be left open.

**Table 1 - Pin Description (continued)**



### 3.0 Mechanical Drawing

**NOTES :**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
2. SOLDER BALL POSITION DESIGNATION PER JE5D 95-1, SPP-010.
3. THIS DIMENSION INCLUDES STAND-OFF HEIGHT, PACKAGE BODY THICKNESS AND LID HEIGHT, BUT DOES NOT INCLUDE ATTACHED FEATURES, E.G., EXTERNAL HEATSINK OR CHIP CAPACITORS. AN INTEGRAL HEATSLUG IS NOT CONSIDERED AN ATTACHED FEATURE.
4. DIMENSION IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.
5. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
6. ALL DIMENSIONS ARE IN MILLIMETERS.

SYMBOL	MILLIMETER			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.57	1.76	1.95	.062	.069	.076
A1	0.4	0.5	0.6	.016	.020	.024
A2		0.56			.022	
A3		0.70			.028	
b	0.5	0.6	0.7	.020	.024	.028
D	12.90	13.00	13.10	.508	.512	.516
D1		11.00			.433	
E	12.90	13.00	13.10	.508	.512	.516
E1		11.00			.433	
e		1.00			.039	

**Microsemi CMPG**

TITLE: 144 LBGGA PACKAGE OUTLINE  
BODY SIZE 0.3 X 13 X1.76MM MAX  
PITCH: 1.2MM

DATE: 22-0017	REV: 4
REV: 84-06-25-225	SIZE: A4
SHEET: 1	OF: 1

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