

## Applications

- ITU-T G.8262 System Timing Cards which support 1 GbE and 10 GbE interfaces
- Telcordia GR-253 Carrier Grade SONET/SDH Stratum 2/3E/3 System Timing Cards
- System Timing Cards which support ITU-T G.781 SETS (SDH Equipment Timing Source)

## Change Summary

The following table captures the changes from February 2008 issue to March 2013 issue.

Page	Item	Change
Multiple	Zarlink logo and name reference	Updated to Microsemi <sup>®</sup> logo and name.

The following table captures the changes from the February 2008 issue.

Page	Item	Change
1	Feature list	Added support for G.823, G.824 and G.8261
4	p0_clk and p1_clk maximum clock frequency	Changed max frequency of the P0 and P1 clocks from 77.76 MHz to 100 MHz.

## Pin Description

Pin #	Name	I/O Type	Description
<b>Input Reference</b>			
C1 B2 A3 C3 B3 B4 C4 A4	ref0 ref1 ref2 ref3 ref4 ref5 ref6 ref7	I <sub>u</sub>	<b>Input References 7:0 (LVCMOS, Schmitt Trigger).</b> These input references are available to both DPLL1 and DPLL2 for synchronizing output clocks. All eight input references can lock to any multiple of 8 kHz up to 77.76 MHz including 25 MHz and 50 MHz. Input ref0 and ref1 have additional configurable pre-dividers allowing input frequencies of 62.5 MHz, 125 MHz, and 155.52 MHz. These pins are internally pulled up to V <sub>dd</sub> .
B1 A1 A2	sync0 sync1 sync2	I <sub>u</sub>	<b>Frame Pulse Synchronization References 2:0 (LVCMOS, Schmitt Trigger).</b> These are optional frame pulse synchronization inputs associated with input references 0, 1 and 2. These inputs accept frame pulses in a clock format (50% duty cycle) or a basic frame pulse format with minimum pulse width of 5 ns. These pins are internally pulled up to V <sub>dd</sub> .
C5	ref8/ext_fb_clk	I <sub>u</sub>	<b>Input Reference 8/External DPLL Feedback Clock (LVCMOS, Schmitt Trigger).</b> This pin acts as either an ext_fb_clk input or as the ref8 input. The desired function for the pin is selectable through the software interface with a programmable register bit. This pin is internally pulled up to V <sub>dd</sub> . Leave open when not in use.
B5	sync8/ext_fb_fp	I <sub>u</sub>	<b>Frame Pulse Synchronization Reference 8/External DPLL Feedback Frame Pulse (LVCMOS, Schmitt Trigger).</b> This pin acts as either an ext_fb_fp input or as the sync8 input. The desired function for the pin is selectable through the software interface with a programmable register bit. This pin is internally pulled up to V <sub>dd</sub> . Leave open when not in use.
<b>Output Clocks and Frame Pulses</b>			
A9 B10	diff0_p diff0_n	O	<b>Differential Output Clock 0 (LVPECL).</b> When in SONET/SDH mode, this output can be configured to provide any one of the available SONET/SDH clocks (6.48 MHz, 19.44 MHz, 38.88 MHz, 51.84 MHz, 77.76 MHz, 155.52 MHz, 311.04 MHz, 622.08 MHz). When in Ethernet mode, this output can be configured to provide any of the Ethernet clocks (25 MHz, 50 MHz, 62.5 MHz, 125 MHz, 156.25 MHz, 312.5 MHz). See "Output Clocks and Frame Pulses" on page 31 for more details on clock frequency settings.
A10 B9	diff1_p diff1_n	O	<b>Differential Output Clock 1 (LVPECL).</b> When in SONET/SDH mode, this output can be configured to provide any one of the available SONET/SDH clocks (6.48 MHz, 19.44 MHz, 38.88 MHz, 51.84 MHz, 77.76 MHz, 155.52 MHz, 311.04 MHz, 622.08 MHz). When in Ethernet mode, this output can be configured to provide any of the Ethernet clocks (25 MHz, 50 MHz, 62.5 MHz, 125 MHz, 156.25 MHz, 312.5 MHz). See "Output Clocks and Frame Pulses" on page 31 for more details on clock frequency settings.
D10	apll_clk0	O	<b>APLL Output Clock 0 (LVCMOS).</b> This output can be configured to provide any one of the SONET/SDH clock outputs up to 77.76 MHz or any of the Ethernet clock rates up to 125 MHz. The default frequency for this output is 77.76 MHz.
G10	apll_clk1	O	<b>APLL Output Clock 1 (LVCMOS).</b> This output can be configured to provide any one of the SONET/SDH clock outputs up to 77.76 MHz or any of the Ethernet clock rates up to 125 MHz. The default frequency for this output is 19.44 MHz.

Pin #	Name	I/O Type	Description
E10	apll_fp0	O	<b>APLL Output Frame Pulse 0 (LVCMOS).</b> This output can be configured to provide virtually any style of output frame pulse synchronized with an associated SONET/SDH family output clock. The default frequency for this frame pulse output is 8 kHz.
F10	apll_fp1	O	<b>APLL Output Frame Pulse 1 (LVCMOS).</b> This output can be configured to provide virtually any style of output frame pulse synchronized with an associated SONET/SDH family output clock. The default frequency for this frame pulse output is 2 kHz.
K9	p0_clk0	O	<b>Programmable Synthesizer 0 - Output Clock 0 (LVCMOS).</b> This output can be configured to provide any frequency with a multiple of 8 kHz up to 77.76 MHz in addition to 2 kHz. The default frequency for this output is 2.048 MHz.
K7	p0_clk1	O	<b>Programmable Synthesizer 0 - Output Clock 1 (LVCMOS).</b> This is a programmable clock output configurable as a multiple or division of the p0_clk0 frequency within the range of 2 kHz to 77.76 MHz. The default frequency for this output is 8.192 MHz.
K8	p0_fp0	O	<b>Programmable Synthesizer 0 - Output Frame Pulse 0 (LVCMOS).</b> This output can be configured to provide virtually any style of output frame pulse associated with the p0 clocks. The default frequency for this frame pulse output is 8 kHz.
J7	p0_fp1	O	<b>Programmable Synthesizer 0 - Output Frame Pulse 1 (LVCMOS).</b> This output can be configured to provide virtually any style of output frame pulse associated with the p0 clocks. The default frequency for this frame pulse output is 8 kHz.
J10	p1_clk0	O	<b>Programmable Synthesizer 1 - Output Clock 0 (LVCMOS).</b> This output can be configured to provide any frequency with a multiple of 8 kHz up to 100 MHz in addition to 2 kHz. The default frequency for this output is 1.544 MHz (DS1).
K10	p1_clk1	O	<b>Programmable Synthesizer1 - Output Clock 1 (LVCMOS).</b> This is a programmable clock output configurable as a multiple or division of the p1_clk0 frequency within the range of 2 kHz to 100 MHz. The default frequency for this output is 3.088 MHz (2x DS1).
H10	fb_clk	O	<b>Feedback Clock (LVCMOS).</b> This output is a buffered copy of the feedback clock for DPLL1. The frequency of this output always equals the frequency of the selected reference.
E1	dpll2_ref	O	<b>DPLL2 Selected Output Reference (LVCMOS).</b> This is a buffered copy of the output of the reference selector for DPLL2. Switching between input reference clocks at this output is not hitless.
<b>Control</b>			
H5	rst_b	I	<b>Reset (LVCMOS, Schmitt Trigger).</b> A logic low at this input resets the device. To ensure proper operation, the device must be reset after power-up. Reset should be asserted for a minimum of 300 ns.
J5	dpll1_hs_en	I <sub>U</sub>	<b>DPLL1 Hitless Switching Enable (LVCMOS, Schmitt Trigger).</b> A logic high at this input enables hitless reference switching. A logic low disables hitless reference switching and re-aligns DPLL1's output phase to the phase of the selected reference input. This feature can also be controlled through software registers. This pin is internally pulled up to Vdd.

Pin #	Name	I/O Type	Description
C2 D2	dpll1_mod_sel0 dpll1_mod_sel1	I <sub>U</sub>	<b>DPLL1 Mode Select 1:0 (LVCMOS, Schmitt Trigger).</b> During reset, the levels on these pins determine the default mode of operation for DPLL1 (Automatic, Normal, Holdover or Freerun). After reset, the mode of operation can be controlled directly with these pins, or by accessing the dpll1_modesel register (0x1F) through the serial interface. This pin is internally pulled up to Vdd.
D1	slave_en	I <sub>U</sub>	<b>Master/Slave control (LVCMOS, Schmitt Trigger).</b> This pin selects the mode of operation for the device. If set high, slave mode is selected. If set low, master mode is selected. This feature can also be controlled through software registers. This pin is internally pulled up to Vdd.
K1	diff0_en	I <sub>U</sub>	<b>Differential Output 0 Enable (LVCMOS, Schmitt Trigger).</b> When set high, the differential LVPECL output 0 driver is enabled. When set low, the differential driver is tristated reducing power consumption. This pin is internally pulled up to Vdd.
D3	diff1_en	I <sub>U</sub>	<b>Differential Output 1 Enable (LVCMOS, Schmitt Trigger).</b> When set high, the differential LVPECL output 1 driver is enabled. When set low, the differential driver is tristated reducing power consumption. This pin is internally pulled up to Vdd.
<b>Status</b>			
H1	dpll1_lock	O	<b>Lock Indicator (LVCMOS).</b> This is the lock indicator pin for DPLL1. This output goes high when DPLL1's output is frequency and phase locked to the input reference.
J1	dpll1_holdover	O	<b>Holdover Indicator (LVCMOS).</b> This pin goes high when DPLL1 enters the holdover mode.
<b>Serial Interface</b>			
E2	sck_scl	I/B	<b>Clock for Serial Interface (LVCMOS).</b> Serial interface clock. When i2c_en = 0, this pin acts as the sck pin for the serial interface. When i2c_en = 1, this pin acts as the scl pin (bidirectional) for the I <sup>2</sup> C interface.
F1	si_sda	I/B	<b>Serial Interface Input (LVCMOS).</b> Serial interface data pin. When i2c_en = 0, this pin acts as the si pin for the serial interface. When i2c_en = 1, this pin acts as the sda pin (bidirectional) for the I <sup>2</sup> C interface.
G1	so	O	<b>Serial Interface Output (LVCMOS).</b> Serial interface data output. When i2c_en = 0, this pin acts as the so pin for the serial interface. When i2c_en = 1, this pin is unused and should be left unconnected.
E3	cs_b_ase10	I <sub>U</sub>	<b>Chip Select/Address Select 0 for the Serial Interface (LVCMOS).</b> Serial interface chip select. When i2c_en = 0, this pin acts as the cs pin (active low) for the serial interface. When i2c_en = 1, this pin acts as the ase10 pin for the I <sup>2</sup> C interface.
G2	int_b	O	<b>Interrupt Pin (LVCMOS).</b> Indicates a change of device status prompting the processor to read the enabled interrupt service registers (ISR). This pin is an open drain, active low and requires an external pulled up to VDD.
J2	i2c_en	I <sub>U</sub>	<b>I<sup>2</sup>C Interface Enable (LVCMOS).</b> If set high, the I <sup>2</sup> C interface is enabled, if set low, the SPI interface is enabled. Internally pull-up to Vdd.

Pin #	Name	I/O Type	Description
<b>APLL Loop Filter</b>			
A6	apll_filter	A	External Analog PLL Loop Filter terminal.
B6	filter_ref0	A	Analog PLL External Loop Filter Reference.
C6	filter_ref1	A	Analog PLL External Loop Filter Reference.
<b>JTAG and Test</b>			
J4	tdo	O	<b>Test Serial Data Out (Output).</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.
K2	tdi	I <sub>u</sub>	Test Serial Data In (Input). JTAG serial test instructions and data are shifted in on this pin. This pin is internally pulled up to Vdd. If this pin is not used then it should be left unconnected.
H4	trst_b	I <sub>u</sub>	<b>Test Reset (LVCMOS).</b> Asynchronously initializes the JTAG TAP controller by putting it in the Test-Logic-Reset state. This pin should be pulsed low on power-up to ensure that the device is in the normal functional state. This pin is internally pulled up to Vdd. If this pin is not used then it should be connected to GND.
K3	tck	I	<b>Test Clock (LVCMOS):</b> Provides the clock to the JTAG test logic. If this pin is not used then it should be pulled down to GND.
J3	tms	I <sub>u</sub>	Test Mode Select (LVCMOS). 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>			
K4	osci	I	<b>Oscillator Master Clock Input (LVCMOS).</b> This input accepts a 20 MHz reference from a clock oscillator (TCXO, OCXO). The stability and accuracy of the clock at this input determines the free-run accuracy and the long term holdover stability of the output clocks.
K5	osco	O	<b>Oscillator Master Clock Output (LVCMOS).</b> This pin must be left unconnected when the osci pin is connected to a clock oscillator.
<b>Miscellaneous</b>			
J6 G3	IC		<b>Internal Connection.</b> Connect to ground.
K6	IC		<b>Internal Connection.</b> Leave unconnected.
F2 F3 H7	NC		<b>No Connection.</b> Leave unconnected.

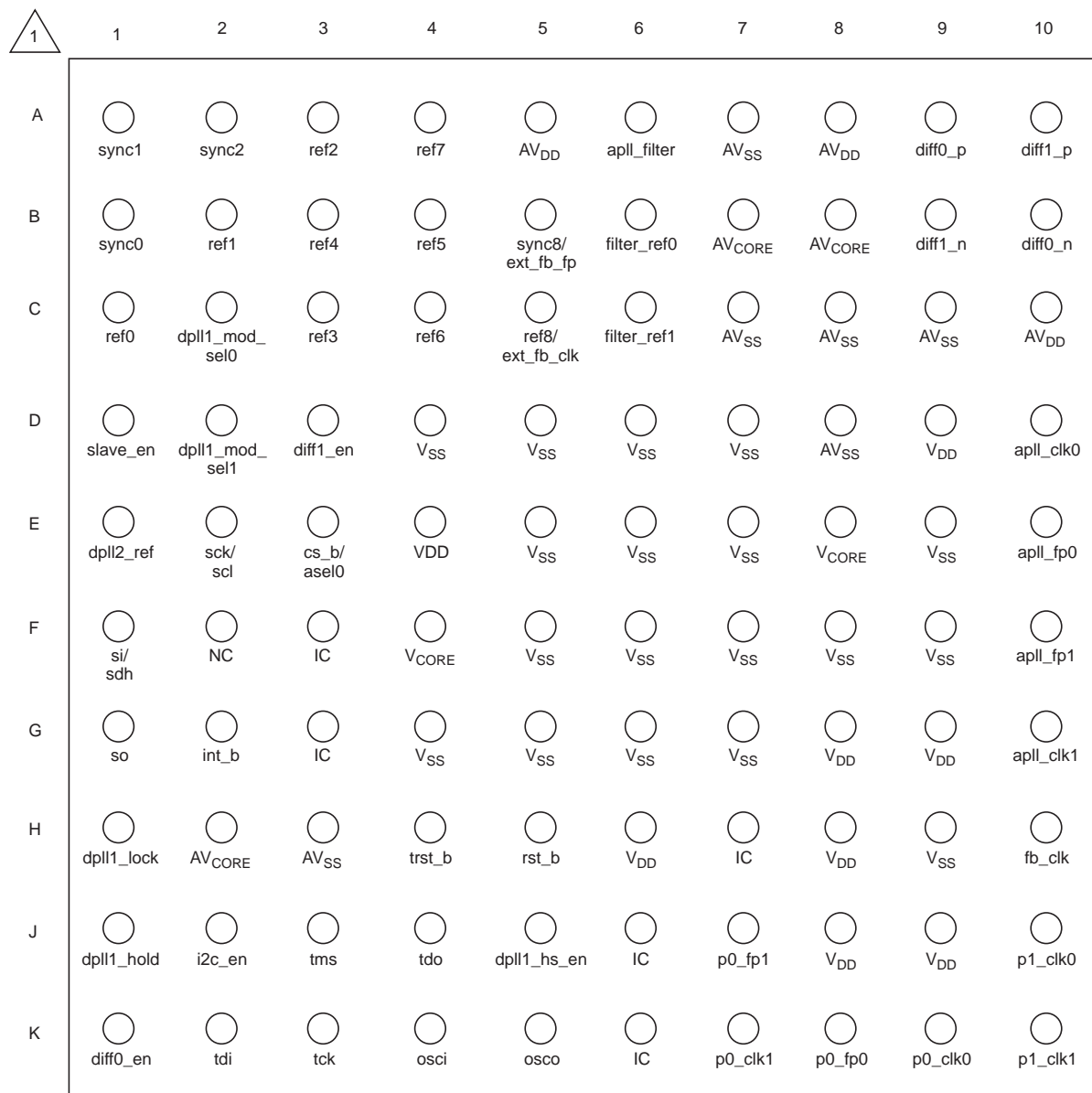
Pin #	Name	I/O Type	Description
<b>Power and Ground</b>			
D9 E4 G8 G9 J8 J9 H6 H8	V <sub>DD</sub>	P P P P P P P P	<b>Positive Supply Voltage.</b> +3.3V <sub>DC</sub> nominal.
E8 F4	V <sub>CORE</sub>	P P	<b>Positive Supply Voltage.</b> +1.8V <sub>DC</sub> nominal.
A5 A8 C10	AV <sub>DD</sub>	P P P	<b>Positive Analog Supply Voltage.</b> +3.3V <sub>DC</sub> nominal.
B7 B8 H2	AV <sub>CORE</sub>	P P P	<b>Positive Analog Supply Voltage.</b> +1.8V <sub>DC</sub> nominal.
D4 D5 D6 D7 E5 E6 E7 F5 F6 F7 G4 G5 G6 G7 E9 F8 F9 H9	V <sub>SS</sub>	G G G G G G G G G G G G G G G G G G G G	<b>Ground.</b> 0 Volts.
A7 C7 C8 C9 D8 H3	AV <sub>SS</sub>	G G G G G G	<b>Analog Ground.</b> 0 Volts.

I - Input

I<sub>d</sub> - Input, Internally pulled down  
I<sub>u</sub> - Input, Internally pulled up  
O - Output  
A - Analog  
P - Power  
G - Ground

## 1.0 Pin Diagram

### TOP VIEW



1 - A1 corner is identified by metallized markings.

## 2.0 High Level Overview

The ZL30138 SONET/SDH/Ethernet Stratum 2/3E/3 System Synchronizer and SETS device is a highly integrated device that provides all of the functionality that is required for a central timing card in carrier grade network equipment. The basic functions of a central timing card include:

- Input reference monitoring for both frequency accuracy and phase irregularities
- Automatic input reference selection
- Support of both external timing and line timing modes
- Hitless reference switching
- Wander and jitter filtering
- Optional Input phase transient filtering (Stratum 3E phase build-out)
- Master/slave crossover for minimizing phase alignment between redundant timing cards
- Independent derived output timing path for support of the SETS functionality

In a typical application, the main timing path uses DPLL1 to synchronize to either an external BITS source or to a recovered line timed source. DPLL1 monitors all references and automatically selects the best available reference based on configurable priority and revertive properties. DPLL1 provides the wander filtering function and the P0 synthesizer generates a jitter filtered clock and frame pulse for the system timing bus which supplies all line cards with a common timing reference. The APLL is used to generate a reference clock for an Ethernet PHY which can be used to synchronize remote equipment. A derived output timing path using DPLL2 is available to support the SETS function. In this case DPLL2 uses a filter above 10 Hz to prevent it from filtering wander.

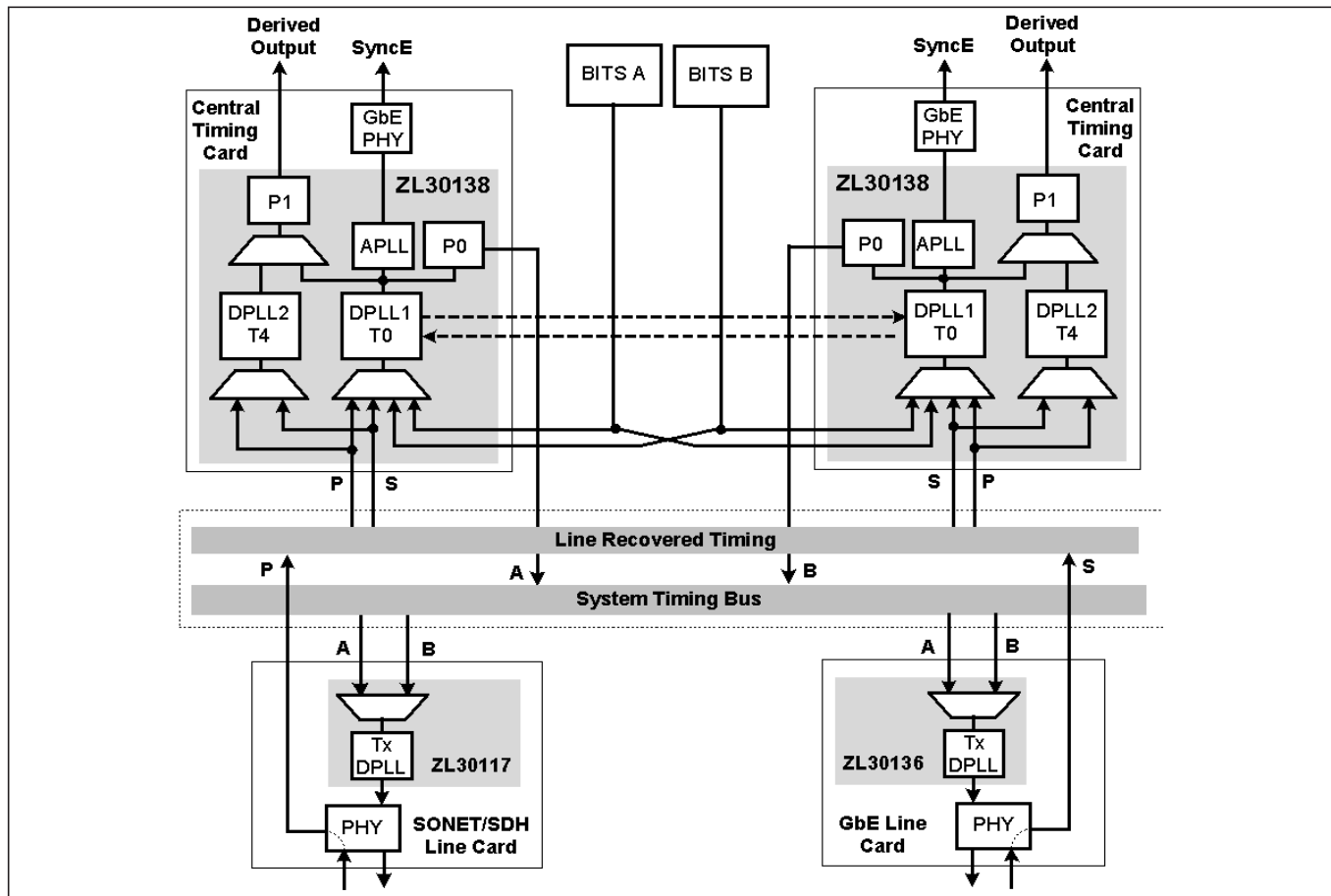
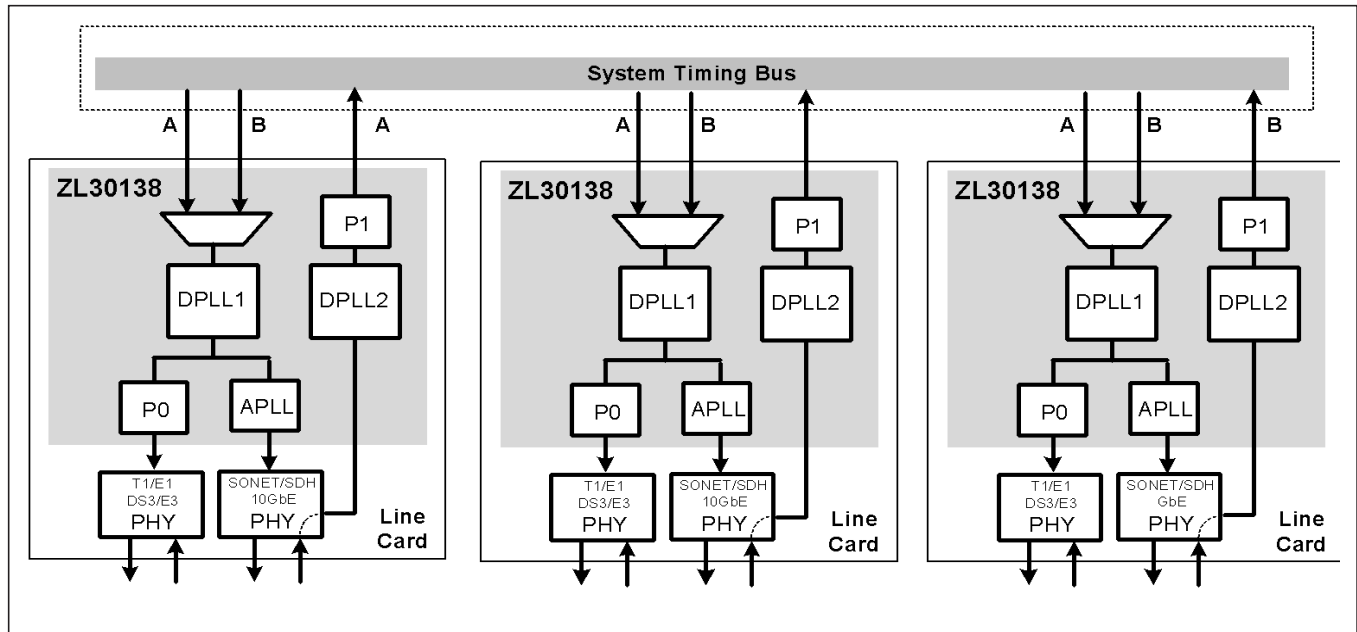


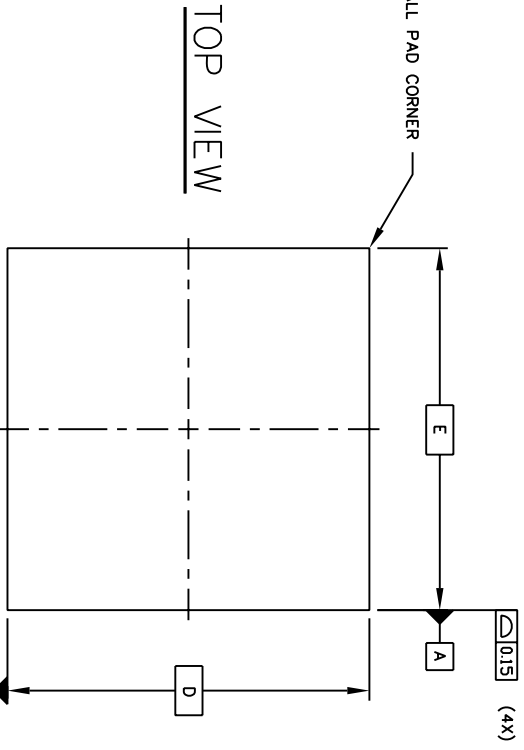
Figure 2 - Typical Application of the ZL30138



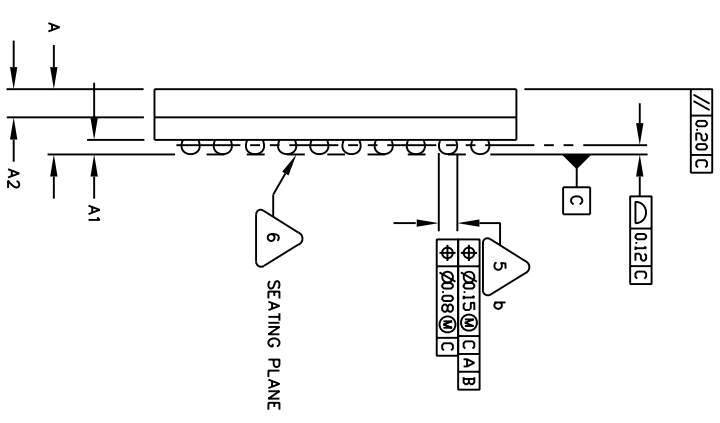
Alternatively, the ZL30138 could be used in systems that were not designed with central timing cards in mind. In this case, the ZL30138 provides all of the features required to meet both the timing card and the line card functions in one package. This application is shown in Figure 3. DPLL1 recovers the reference clock from the backplane and filters wander. The APLL and the P0 synthesizer filter jitter and generate transmit clocks for a SONET/SDH/10GbE PHY (up to OC-192/STM-64) and/or a PDH PHY (T1/E1, DS3/E3, etc). DPLL2 is used to recover the line timing reference, filter jitter, and translate its frequency to the rate required by the backplane.



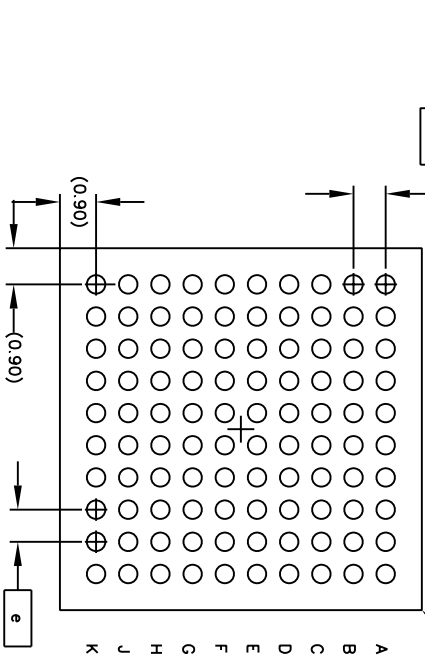
**Figure 3 - The ZL30138 as a Timing Card and a Line Card Device**



TOP VIEW



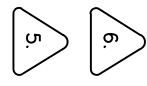
SIDE VIEW



BOTTOM VIEW

100 SOLDER BALLS

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.52	1.62	1.72
A1	0.31	0.36	0.41
A2	0.65	0.70	0.75
b	0.46 Typ.		
D	8.85	9.00	9.15
E	8.85	9.00	9.15
e	0.8 Ref		
n	100		



PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

DIMENSION b IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.

1. THE MAXIMUM ALLOWABLE NUMBER OF SOLDER BALLS IS 100.
  2. Not to Scale.
  3. THE BASIC SOLDER BALL GRID PITCH IS 0.8mm.
  4. ALL DIMENSIONS AND TOLERANCES CONFORM TO ASME Y14.5M-1994.
- NOTES: UNLESS OTHERWISE SPECIFIED

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1	2	3	
CDCA	CDCA	CDCA	
15April05	24Aug05	26Oct06	



Previous package codes		Package Code	GG
N/A		Package Outline for 100ball 9x9mm, 0.8 mm Pitch, 4 layer, CABGA	
		111040	

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**Microsemi Corporate Headquarters**  
One Enterprise, Aliso Viejo CA 92656 USA  
Within the USA: +1 (949) 380-6100  
Sales: +1 (949) 380-6136  
Fax: +1 (949) 215-4996

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