SY15-S3

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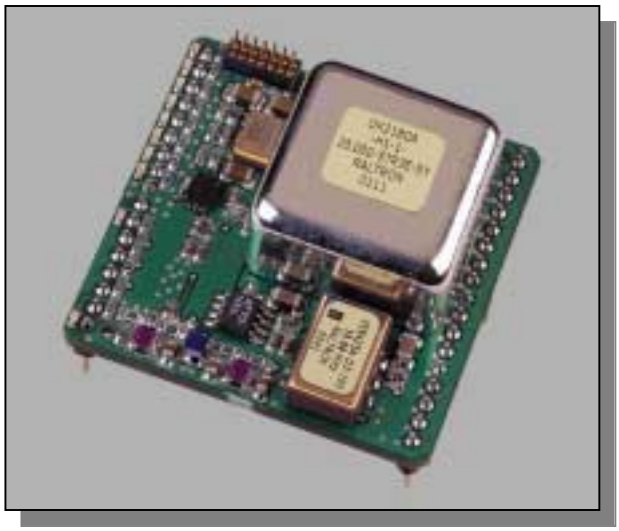

• INTRODUCTION

The SY15-S3 is an accurate time and frequency source, with high frequency, outputs that has been designed as a subsystem level module. The module is designed to work within ATM, SONET, SDH, and wireless systems environments where synchronization is vital. The SY15-S3 is an enhanced version of SY01 and is designed for Stratum 3 applications, but also holds certain features that can make it useful for SONET Minimum Clock (SMC) or other kinds of system clocks.

• FEATURES

√ A synchronization solution for timing, jitter and wander concerns in a single module.

√ Complies with ITU-T Recommendations G.813 and ETSI-ETS 300 462-4 and Bellcore GR-1244-CORE for Stratum 3 applications.

√ Supports three modes of operation: Locked to any of References (1-5), Holdover and Free-run.

√ Accepts reference inputs from up to five independent sources from **8 kHz to 77.76 MHz**.

√ Provides three high frequency outputs **up to 622.08 MHz**.

√ Loop filtering utilizing application specific software in the digital signal processor (DSP).

√ Continuously monitors and evaluate input reference signals.

√ Creates a history buffer for Holdover mode operation.

√ Manual or Automatic selection between timing modes.

√ Alarm and status signal.

√ Host interface and JTAG port.

√ Small dimensions of 1.8 x 1.8 x 0.60 inch.

• APPLICATION

The SY15-S3, a Synchronous Equipment Clock (SEC), fulfills clock regeneration function for STRATUM 3 equipment for: ATM, SDH, PDH, and SONET networks. It was designed for network system manufacturers such as: Access Switches, Core Switches, Cross Connects, Digital Multiplexers-Exchangers, and SDH/SONET equipment. The unit is also suitable for designs where a high frequency outputs are required. Wherever a Timing unit with high performance specifications is required, the SY15-S3 can be embedded within the network system and provide all necessary frequencies and interfaces.

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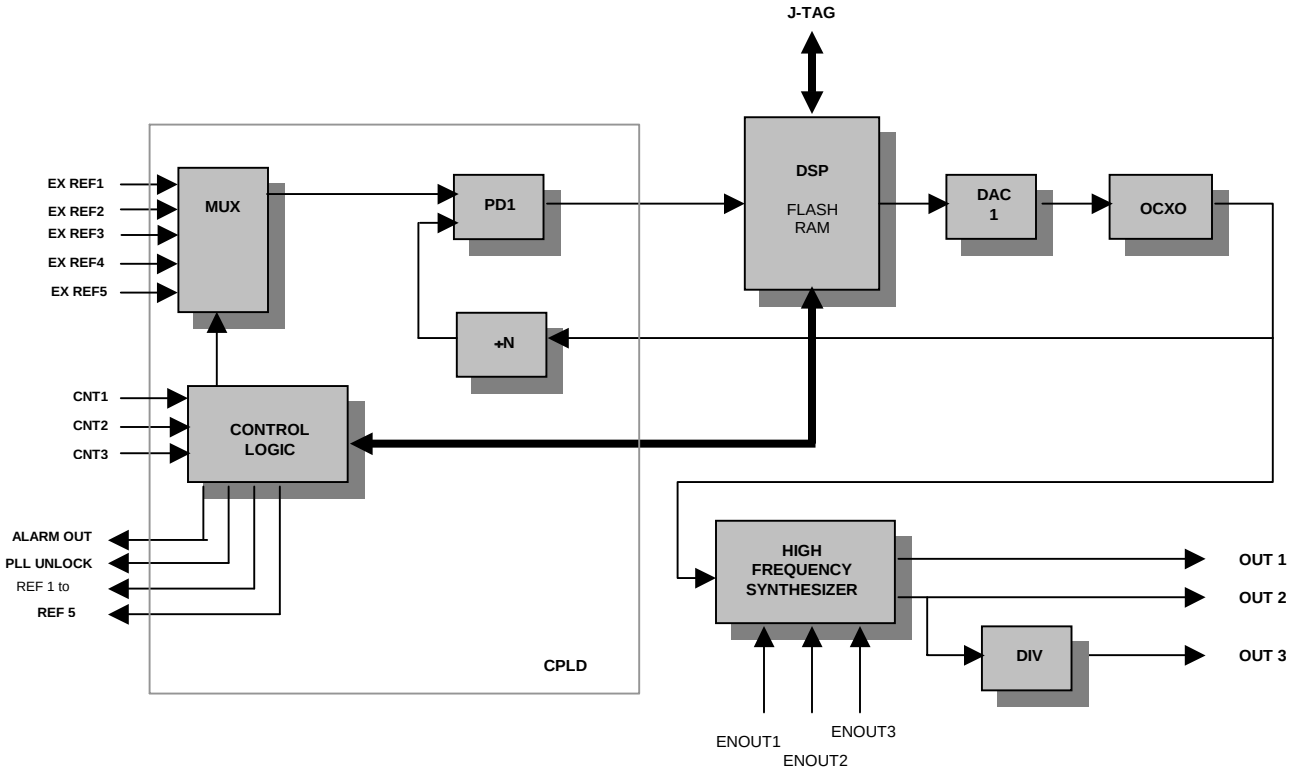

Figure 1. - The functional block diagram of SY15-S3

• DESCRIPTION

The SY15-S3 synchronization module is a Digital PLL (DPLL), which utilizes application specific software in the digital signal processor (DSP). The DSP is complemented by fast hardware logic (CPLD) where all multiplexers, counters, dividers, phase detectors, and other control logic circuits are completely implemented. The functional block diagram with configuration is shown in figure 1. The configuration utilizes one DPLL with an OCXO as on-board oscillator, and one high frequency synthesizer. The OCXO is driven by a digital-to-analog converter (DAC1) and provides the accurate and stable signal under all conditions. The output frequencies are generated by the synthesizer that uses a VCXO and high frequency dividers to provide the output frequencies on all three outputs. For other configurations, please contact RAMI.

✓ **The module operates in the following four timing modes:**

Free-run
In this mode the unit is unlocked to either of the inputs. The accuracy of the output frequencies in this mode is ±4.6ppm. Free-run mode is typically used when a master clock source is required, not valid history of data for the Holdover mode, or immediately following system power-up before network synchronization is achieved. In the Free-run Mode, the SY15-S3 provides timing and synchronization signals that are based on the accuracy of on-board oscillators only, and are not synchronized to the reference signals.

Holdover
In this mode the module has lost its reference inputs and is utilizing stored timing data, called history, to control the output frequency. Holdover Mode is typically used while network synchronization is temporarily disrupted. In Holdover Mode, the SY15-S3 provides timing, based on data from the history buffer, while unlocked to an external reference signal. The history data is determined while the device is locked to an external reference signal. The stability of the output signal in holdover mode depends primarily on the stability of on-board oscillator and environment effects where the clock is mounted. The SY15-S3 uses an OCXO as an on-board oscillator but other types of oscillators are available.

Locked to EX REF.1
In this mode the output of the module is phase locked to input reference 1.

Locked to EX REF.2
In this mode the output of the module is phase locked to input reference 2.

Locked to EX REF.3
In this mode the output of the module is phase locked to input reference 3.

Locked to EX REF.4
In this mode the output of the module is phase locked to input reference 4.

Locked to EX REF.5
In this mode the output of the module is phase locked to input reference 5.

The EX REF1 to EX REF5 Modes are typically used when a slave clock source is synchronized to the network. In these modes, the SY15-S3 provides timing signals, which are synchronized, to one of five references inputs (EX REF1 or EX REF5). The input reference signals may have a variety of nominal frequencies, which is typically specified by the end user. When the modes are selected the unit goes through a reference evaluation, and then a frequency acquisition, and finally to phase locking.

Local Reference Oscillator

Depending on the type of clock, a local reference oscillator is selected. For example: for a Stratum 3 type of clock, the local oscillator can be an AT-cut OCXO or in some cases a good TCXO that meets this standard requirements for frequency drift and jitter noise. For other standards please contact the factory.

- ### Control

The external control is available for the user to control the operation of the SY15-S3. The three external inputs CNT1, CNT2 and CNT3 provide this feature. Below, the truth table shows behavior of the SY15-S3 module according to the control inputs states.

CNT3	CNT2	CNT1	MODE OF OPERATION
0	0	0	Free-run
0	0	1	Locked to EX REF1
0	1	0	Locked to EX REF2
0	1	1	Locked to EX REF3
1	0	0	Locked to EX REF4
1	0	1	Locked to EX REF5
1	1	0	*Ignored*
1	1	1	Holdover

- ### Input References

The SY15-S3 module accepts five input references EX REF1 to EX REF5. End users can specify the frequencies within a range of 8 kHz to 77.76 MHz. The input reference signals are HCMOS/TTL levels with timing characteristic in according to Bellcore GR-1244-core 3.2.1.R3-1 or equivalent standards. Please note that the end user must specify the input frequencies at the time of order.

- ### Output Signals

The SY15-S3 module provides three high frequency output signals OUT1, OUT2 and OUT3. The outputs are generated by the high quality low jitter VCXO and scaled by the output frequency converters. The quality of the output significantly depends on the VCXO oscillator and special care was taken to define its specification. The OUT1 and OUT2 are buffered from VCXO output while the OUT3 is derived by dividing the output frequency of the

VCXO. The division ratio can be from 1 to 8. All outputs are complementary PECL and can be enabled and disabled by external pins ENOUT1, ENOUT2 and ENOUT3.

- **SPECIFICATIONS**

General Specifications	Mechanical	2”(D)x2”(W)x0.75”(H) 1.8”(D)x1.8”(W)x0.60”(H)	Hermetically Sealed Metal box Module on PCB
	Power Supply	5VDC	Regulated
		+3.3VDC	for PECL
	Warm Up Current Supply	TBD	Only with OCXO
	Steady State Current Supply	TBD	
	Operating Temperature	-20°C to 70°C	Other ranges available on request
	Storage Temperature	-40° to 85°C	
	Humidity	5% to 95% non-condensing	
	Internal Oscillators	OCXO or TCXO	
Input Signals	Number of Inputs	5	
	Input reference frequency	8kHz to 77.76MHz	User selectable
	Signal Level	HCMOS/TTL Compatible	
	Time Reference characteristics		Bellcore: GR-1244-core 3.2.1.R3-1
Output Signal	Number of Outputs	3	
	Output 1	155,52 or 622.08MHz	User define
	Output 2	155,52 or 622.08MHz	Same as Output 1
	Output 3	155,52 or 622.08MHz	Output 1 divided by 1,2,4 or 8
	Signal Level	PECL	
Signal Quality Performance	Jitter Tolerance		Bellcore: GR-1244-core 4.2 ITU-T: G.813
	Phase Transient Tolerance		Bellcore: GR-1244-core 4.4
	Wander Generation		Bellcore: GR-1244-core 5.3 ITU-T: G.812
	Wander Tolerance		Bellcore: GR-1244-core 4.3 ITU-T: G.812
	Jitter Generation and Transfer		Bellcore: GR-1244-core 5.5 ITU-T: G.812
	Wander Transfer		Bellcore: GR-1244-core 5.4 ITU-T: G.812
	Jitter	<1ps RMS	On all outputs within the bandwidth 12kHz-20MHz
Frequency Output Performance	Free run accuracy	±4.6ppm	GR-1244-core 5.1 ITU-T: G.812
	Holdover frequency stability	$\pm 3.7 \times 10^{-7}$ for 24hours	TCXO: $\pm 3.7 \times 10^{-7}$ for 24 hours @ $\Delta T \leq \pm 10°C$
	Initial Offset	$\pm 50 \times 10^{-9}$	Bellcore: GR-1244-core 5.2 ITU-T: G.812
	Temperature	$\pm 280 \times 10^{-9}$	TCXO: $\pm 280 \times 10^{-9}$ within $\Delta T \leq \pm 10°C$ $\pm 1 \times 10^{-6}$ -20°C to 70°C
	Drift	$\pm 40 \times 10^{-9}$	Bellcore: GR-1244-core 5.2 ITU-T: G.812
	DPLL bandwidth	0.1Hz	or adjustable
	Lock Time	<30sec	GR-1244-core 3.7
	Lock accuracy	$\pm 1 \times 10^{-11}$	

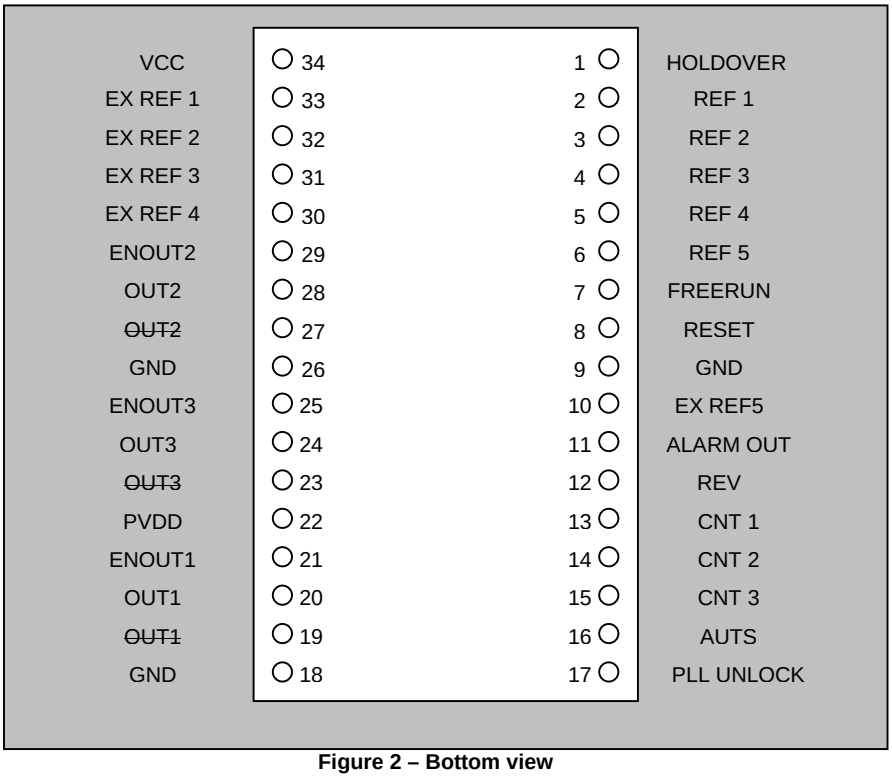

Figure 2 – Bottom view

• PIN ASSIGNMENT

On the picture below it is shown the pin-out for the SY15-S3. The design is done in such a way that is can support basically any other pin-out without changes in the hardware. For other pin-out requirement please contact the factory.

Pin #	Name	Description
1	HOLDOVER	Holdover Signal -> the output is high when the unit is in holdover mode
2	REF 1	Reference 1 Signal -> the output is high when the unit is using the reference 1
3	REF 2	Reference 2 Signal -> the output is high when the unit is using the reference 2
4	REF 3	Reference 3 Signal -> the output is high when the unit is using the reference 3
5	REF 4	Reference 4 Signal -> the output is high when the unit is using the reference 4
6	REF 5	Reference 5 Signal -> the output is high when the unit is using the reference 5
7	FREERUN	Free-run Signal -> the output is high when the unit is in the free run mode
8	RESET	Reset -> input signal, reset the module
9	GND	Ground
10	EX REF 5	External Reference 5 Input -> the input signal from reference 5
11	ALARM OUT	Alarm signal -> the output is high when there is an alarm in the module.
12	REV	Revertive Input-> to set revertive mode (low), to disable revertive mode set the pin high.
13	CNT 1	Control Input 1 -> the external input for selecting mode of the unit – see table above.
14	CNT 2	Control Input 2 -> the external input for selecting mode of the unit – see table above.
15	CNT 3	Control Input 3 -> the external input for selecting mode of the unit – see table above.
16	AUTS	Automatic Switching Input -> to select automating switching between references (low), to disable set high.
17	PLL UNLOCK	PLL Unlocked Signal -> the output is high when the unit is not locked to any of the references
18	GND	Ground
19	~~OUT1~~	Output 1 complementary -> Complementary signal from the Output 1
20	OUT 1	Output 1 -> Signal from the O1
21	ENOUT1	Enable Output 1-> Signal enable output 1 when low
22	PVDD	PECL VDD -> +3.3V, power supply for PECL and VCSO
23	~~OUT3~~	Output 3 complementary -> Complementary signal from the Output 3
24	OUT3	Output 3 -> Signal from the O3
25	ENOUT3	Enable Output 3-> Signal enable output 3 when low
26	GND	Ground
27	~~OUT2~~	Output 2 complementary -> Complementary signal from the Output 2
28	OUT2	Output 2 -> Signal from the O2
29	ENOUT2	Enable Output 2-> Signal enable output 2 when low
30	EX REF 4	External Reference 4 Input -> the input signal from reference 4
31	EX REF 3	External Reference 3 Input -> the input signal from reference 3
32	EX REF 2	External Reference 2 Input -> the input signal from reference 2
33	EX REF 1	External Reference 1 Input -> the input signal from reference 1
34	VCC	Positive Voltage Supply

For other pin-out configurations contact the factory!

- **MECHANICAL DIMENSIONS**

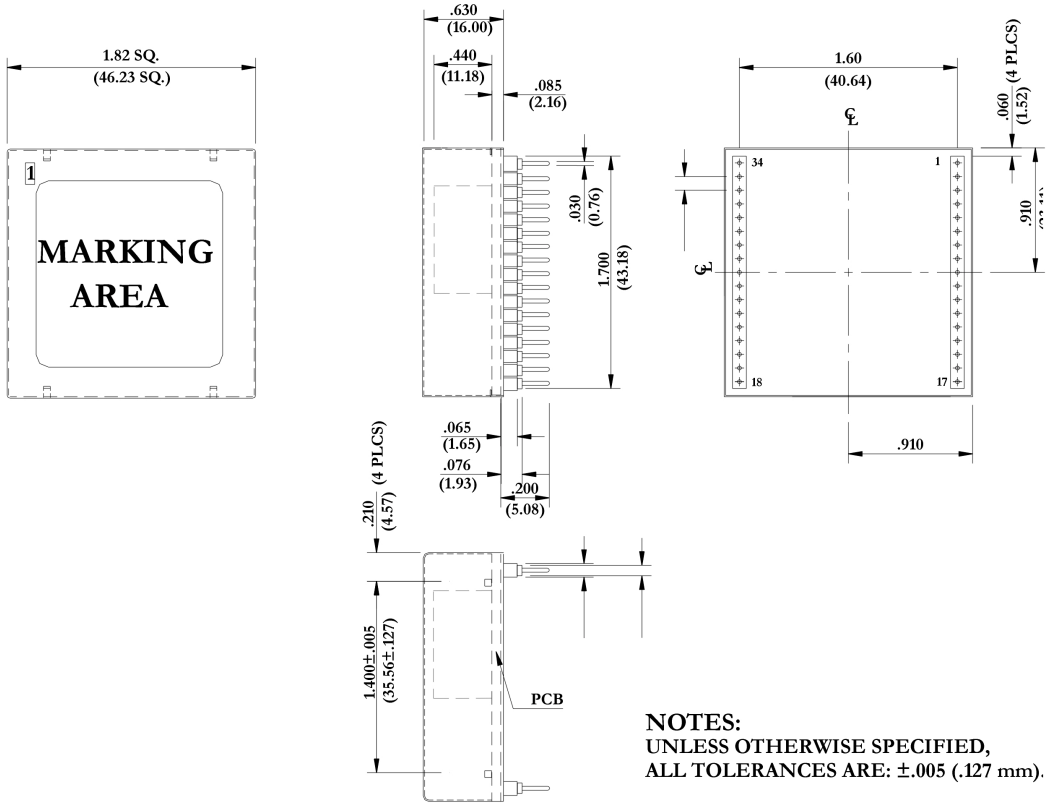

Figure 3 – The mechanical dimensions.

Figure 3. shows the mechanical dimension of the SY15-S3 module. The module can be supplied in two different types of packaging:

- Metal box
- Module without packaging

The dimensions shown on figure are valid for first and second type of packaging, the actual dimensions for the third type are 1.8 x 1.8 x 0.60” keeping the pin-out dimensions the same for all of three. The label on the module shows part number, factory name, week and year of production. The height of the module is 0.50” if a TCXO is used as the reference oscillator!