

**FEATURES**

- Single chip source for 622.08MHz and 155.52MHz clocks
- 622.08MHz output is differential PECL, 155.52MHz output is single-ended PECL
- TTL/CMOS compatible inputs and reference output
- SONET compliant jitter performance ( $\leq 0.01UI$ )
- Choice of three reference frequencies
- Only 395mW (typ)
- Complies with Bellcore, CCITT and ANSI standards
- Single +5 volt power supply
- Fully compatible with industry standard 10KH I/O levels
- Available in 28-pin PLCC package



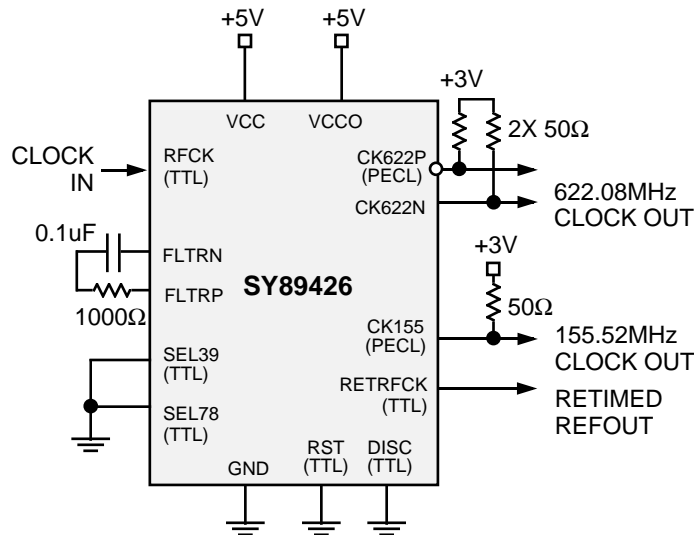
Precision Edge®

**DESCRIPTION**

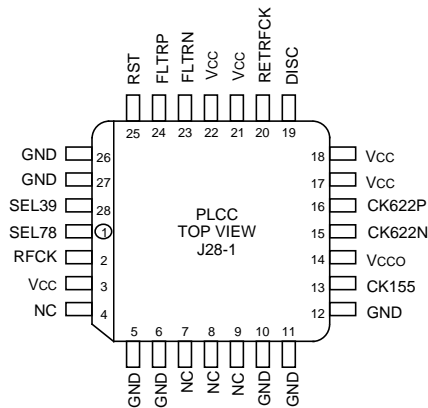
Micrel's SY89426 Multi-Output Phase Locked Loop (PLL) is a SONET compliant clock generator providing 622.08MHz, 155.52MHz and retimed reference clock outputs. The PLL produces low jitter OC-12/STS-12 and OC-3/STS-3 rate clocks from an input reference clock of 38.88, 51.84, or 77.76MHz. Additionally, the input reference clock is retimed and provided as a TTL/CMOS compatible output, which may be disabled to minimize switching noise. The SY89426 operates from a single +5 volt supply, and requires only a simple series RC loop filter.

Coupling Micrel's advanced PLL technology with our proprietary ASSET™ bipolar process has produced a clock generator IC which exceeds applicable Bellcore and ANSI specifications, while setting a new standard for performance and flexibility.

**TYPICAL APPLICATION**



**PACKAGE/ORDERING INFORMATION**



**28-Pin PLCC (J28-1)**

**Ordering Information<sup>(1)</sup>**

| Part Number                   | Package Type | Operating Range | Package Marking                           | Lead Finish      |
|-------------------------------|--------------|-----------------|---|------------------|
| SY89426JC                     | J28-1        | Commercial      | SY89426JC                                 | Sn-Pb            |
| SY89426JCTR <sup>(2)</sup>    | J28-1        | Commercial      | SY89426JC                                 | Sn-Pb            |
| SY89426JY <sup>(3)</sup>      | J28-1        | Industrial      | SY89426JY with Pb-Free bar line indicator | Matte-Sn Pb-Free |
| SY89426JYTR <sup>(2, 3)</sup> | J28-1        | Industrial      | SY89426JY with Pb-Free bar line indicator | Matte-Sn Pb-Free |

**Notes:**

1. Contact factory for die availability. Dice are guaranteed at T<sub>A</sub> = 25°C, DC Electricals only.
2. Tape and Reel.
3. Pb-Free package is recommended for new designs.

**PIN DESCRIPTION**

**INPUTS**

**RFCK [Reference Clock]** TTL  
Reference clock IN. (38.88, 51.84 or 77.76MHz).

**SEL39 [38.88MHz Select]** TTL  
Logic HIGH on this pin denotes a 38.88MHz input reference clock. Tie to logic LOW if input is not 38.88MHz.

**SEL78 [77.76MHz Select]** TTL  
Logic HIGH on this pin denotes a 77.76MHz input reference clock. Tie to logic LOW if input is not 77.76MHz.

**RST [Reset]** TTL  
Tie to logic LOW for normal operation; logic HIGH forces reset of internal Phase Detector & feedback dividers.

**FLTRP, FLTRN [Loop Filter, Pos & Neg]** Analog  
Connect a series RC loop filter between these pins. The suggested RC values are 500Ω and 0.1μF, as shown in the Typical Application.

**DISC [Disable Clock]** TTL  
Logic HIGH on this pin disables the Retimed Reference Clock output (RETRFCK); if this output is not required, it is recommended that it be disabled to reduce switching noise. A logic LOW enables the output.

**OUTPUTS**

**CK622P, CK622N [622 Clock Output]** Differential PECL.  
622.08MHz output clock from PLL B.

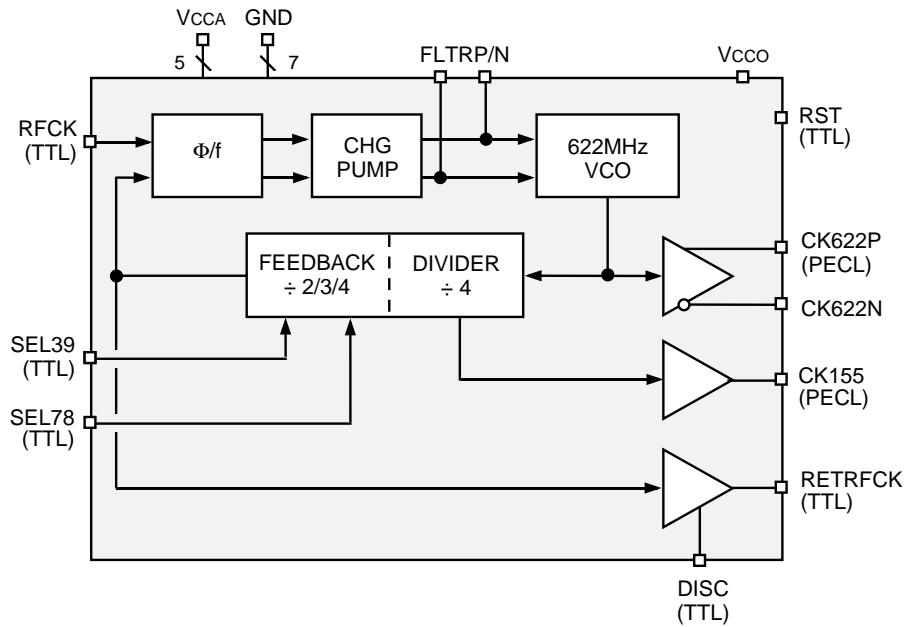
**CK155 [155 Clock Out]** Single-ended PECL  
155.52MHz output clock.

**RETRFCK [Retimed Reference Clock Out]** TTL  
An output clock with the same frequency as the input Reference Clock (RFCK) and a 45-55% duty cycle. This output is derived by dividing the 622.08MHz output by the appropriate factor (e.g., divide by 16 for a 38.88MHz inout reference; divide by 12 for 51.84Mhz in; or divide by 8 for 77.76MHz in).

**POWER & GROUND**

- Vcc** +5V for internal circuits.
- Vcco** +5V for PECL outputs.
- GND** Ground (0 volts).

**FUNCTIONAL BLOCK DIAGRAM**



**REFERENCE FREQUENCY SELECTION<sup>(1)</sup>**

| SEL39 | SEL78 | f <sub>RFCK</sub> |
|-------|-------|-------------------|
| 0     | 0     | 51.84             |
| 0     | 1     | 77.76             |
| 1     | 0     | 38.88             |
| 1     | 1     | 77.76             |

**NOTE:**

1. Airflow greater than 500lfpm is maintained.

**ABSOLUTE MAXIMUM RATINGS<sup>(1), (2)</sup>**

| Symbol             | Parameter                             | Rating               | Unit |
|--------------------|---------------------------------------|----------------------|------|
| V <sub>CC</sub>    | Power Supply                          | 0 to +7              | V    |
| V <sub>IN</sub>    | Input Voltage                         | 0 to V <sub>CC</sub> | V    |
| I <sub>OUT</sub>   | Output Current                        | -Continuous          | 50   |
|                    |                                       | -Surge               | 100  |
| T <sub>A</sub>     | Operating Temperature Range           | -40 to +85           | °C   |
| T <sub>LEAD</sub>  | Lead Temperature (soldering, 20 sec.) | +260                 | °C   |
| T <sub>store</sub> | Storage Temperature Range             | -65 to +150          | °C   |

**NOTES:**

1. Permanent device damage may occur if absolute maximum ratings are exceeded. This is a stress rating only and functional operation is not implied at conditions other than those detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. Airflow greater than 500lfpm is maintained.

**PECL DC ELECTRICAL CHARACTERISTIC<sup>(1), (2)</sup>**

V<sub>CC</sub> = V<sub>CCO</sub> = +5V ± 5%; GND = 0V; T<sub>A</sub> = -40°C to 85°C

| Symbol          | Parameter                         | T <sub>A</sub> = -40°C |                       | T <sub>A</sub> = 0°C  |                       | T <sub>A</sub> = +25°C |                       | T <sub>A</sub> = +85°C |                       | Unit |
|-----------------|-----------------------------------|------------------------|-----------------------|-----------------------|-----------------------|------------------------|-----------------------|------------------------|-----------------------|------|
|                 |                                   | Min.                   | Max.                  | Min.                  | Max.                  | Min.                   | Max.                  | Min.                   | Max.                  |      |
| V <sub>OH</sub> | Output HIGH Voltage               | V <sub>CC</sub> -1130  | V <sub>CC</sub> -840  | V <sub>CC</sub> -1070 | V <sub>CC</sub> -790  | V <sub>CC</sub> -1030  | V <sub>CC</sub> -760  | V <sub>CC</sub> -960   | V <sub>CC</sub> -670  | mV   |
| V <sub>OL</sub> | Output LOW Voltage                | V <sub>CC</sub> -2000  | V <sub>CC</sub> -1600 | V <sub>CC</sub> -2000 | V <sub>CC</sub> -1580 | V <sub>CC</sub> -2000  | V <sub>CC</sub> -1580 | V <sub>CC</sub> -2000  | V <sub>CC</sub> -1545 | mV   |
| V <sub>IH</sub> | Input HIGH Voltage <sup>(1)</sup> | V <sub>CC</sub> -1230  | V <sub>CC</sub> -890  | V <sub>CC</sub> -1170 | V <sub>CC</sub> -840  | V <sub>CC</sub> -1130  | V <sub>CC</sub> -810  | V <sub>CC</sub> -1060  | V <sub>CC</sub> -720  | mV   |
| V <sub>IL</sub> | Input LOW Voltage <sup>(1)</sup>  | V <sub>CC</sub> -1950  | V <sub>CC</sub> -1500 | V <sub>CC</sub> -1950 | V <sub>CC</sub> -1480 | V <sub>CC</sub> -1950  | V <sub>CC</sub> -1480 | V <sub>CC</sub> -1950  | V <sub>CC</sub> -1445 | mV   |
| I <sub>IL</sub> | Input LOW Current                 | 0.5                    | —                     | 0.5                   | —                     | 0.5                    | —                     | 0.3                    | —                     | µA   |

**NOTES:**

1. Forcing one input at a time. Apply V<sub>IH</sub> (Max) or V<sub>IL</sub> (Min) to all other inputs.
2. Airflow greater than 500lfpm is maintained.

**TTL DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>**

V<sub>CC</sub> = V<sub>CCO</sub> = +5V ± 5%; GND = 0V; T<sub>A</sub> = -40°C to 85°C

| Symbol          | Parameter                    | Min. | Max. | Unit | Condition              |
|-----------------|------------------------------|------|------|------|------------------------|
| V <sub>OH</sub> | Output HIGH Voltage          | 2.4  | —    | V    | I <sub>OH</sub> = -2mA |
| V <sub>OL</sub> | Output LOW Voltage           | —    | 0.5  | V    | I <sub>OL</sub> = 4mA  |
| I <sub>OS</sub> | Output Short Circuit Current | -150 | -60  | mA   | V <sub>OUT</sub> = 0   |
| V <sub>IH</sub> | Input HIGH Voltage           | 2.0  | —    | V    | —                      |
| V <sub>IL</sub> | Input LOW Voltage            | —    | 0.8  | V    | —                      |

**NOTE:**

1. Airflow greater than 500lfpm is maintained.

**DC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>**

V<sub>CC</sub> = V<sub>CCO</sub> = +5V ± 5%; GND = 0V; T<sub>A</sub> = -40°C to 85°C

| Symbol           | Parameter                  | Min. | Typ. | Max. | Unit | Condition                                 |
|------------------|----------------------------|------|------|------|------|---|
| I <sub>EE</sub>  | Internal Operating Current | —    | 79   | 120  | mA   |   |
| I <sub>OUT</sub> | Termination Output Current | —    | 11   | —    | mA   | 50Ω to V <sub>CC</sub> -2, 50% duty cycle |

**NOTE:**

1. Airflow greater than 500lfpm is maintained.

**AC ELECTRICAL CHARACTERISTICS<sup>(1)</sup>**

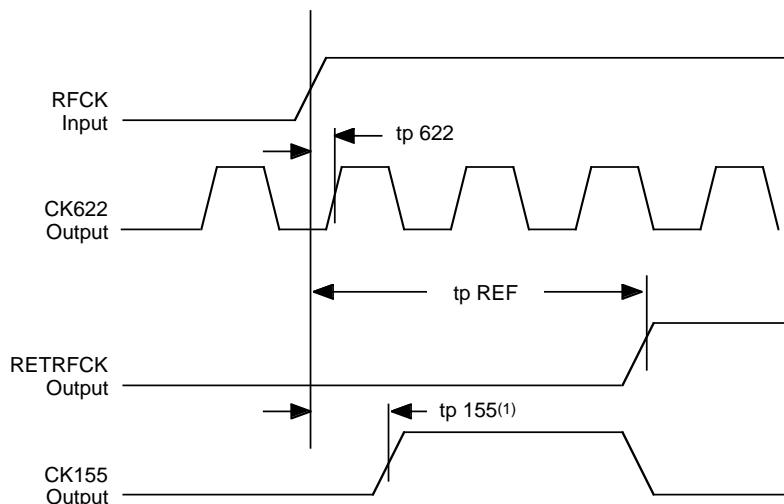
VCC = VCCO = +5V ± 5%; GND = 0V; TA = -40°C to 85°C

| Parameter                                     | Min.       | Typ. | Max. | Units   | Condition                          |
|---|------------|------|------|---------|------------------------------------|
| VCO Center Frequency                          | 622.08 ±1% |      |      | MHz     | Nominal                            |
| Reference Clock (RFCK)<br>Frequency Tolerance | —          | ±20  | —    | ppm     | 77.76MHz                           |
|   | —          | ±20  | —    | ppm     | 51.84MHz                           |
|   | —          | ±10  | —    | ppm     | 38.88MHz                           |
| Reference Clock (RFCK) Input Duty Cycle       | 45         | —    | 55   | % of UI |                                    |
| Reference Clock (RETRFCK) Output Duty Cycle   | 40         | —    | 60   | % of UI | 15pF load                          |
| Acquisition Lock Time                         | —          | —    | 15   | μsec    |                                    |
| TTL Output Rise/Fall Time                     | —          | —    | 2    | ns      | 10% to 90% of amplitude, 15pF load |
| PECL Output Rise/Fall Time                    | —          | —    | 500  | ps      | 10% to 90%, 50Ω load, 5pF cap      |
| CK622 Output Duty Cycle                       | 45         | —    | 55   | % of UI |                                    |
| CK155 Output Duty Cycle                       | 45         | —    | 55   | % of UI |                                    |
| tRST – RST pulse width                        | 1          | —    | —    | μsec    |                                    |
| tp622 Static Phase Offset of CK622            | 190        | 400  | 600  | ps      |                                    |
| tp155 Static Phase Offset of CK155            | -250       | -400 | -750 | ps      |                                    |
| tpREF Static Phase Offset of RETRFCK          | —          | +3.5 | —    | ns      |                                    |

**NOTE:**

1. Airflow greater than 500lfpm is maintained.

**TIMING WAVEFORM**



**NOTE:**

1. Does not apply to 52MHz reference

**JITTER GENERATION**

**Jitter Generation Definition**

Bellcore TR-NWT-000499 (Issue 4), section 7.3.3 "Jitter generation is the process whereby jitter appears at the output port of an individual unit of digital equipment in the absence of applied input jitter."

**Jitter Generation Requirement**

Bellcore TA-NWT-000253 (Issue 2), section 5.6.5.2 "For Category II interfaces, jitter generation shall not exceed 0.01 UI rms. For OC-N and STSX-N interfaces, a high-pass measurement filter with a 12kHz cutoff frequency shall be used." The low-pass cutoff frequency of the measurement filter shall be higher than 5MHz.

The characteristic of the measurement filter is shown below.

**SONET OC-12 Category II Jitter Generation Measurement Filter Characteristics**

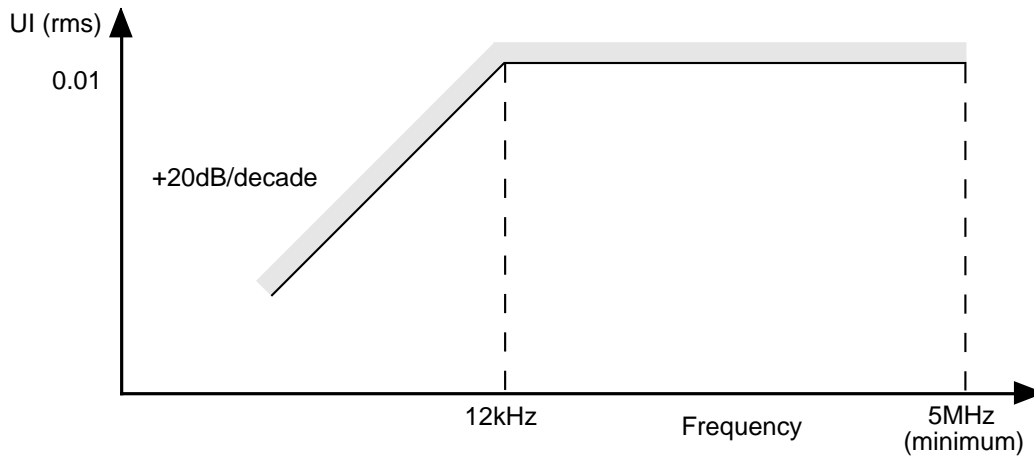
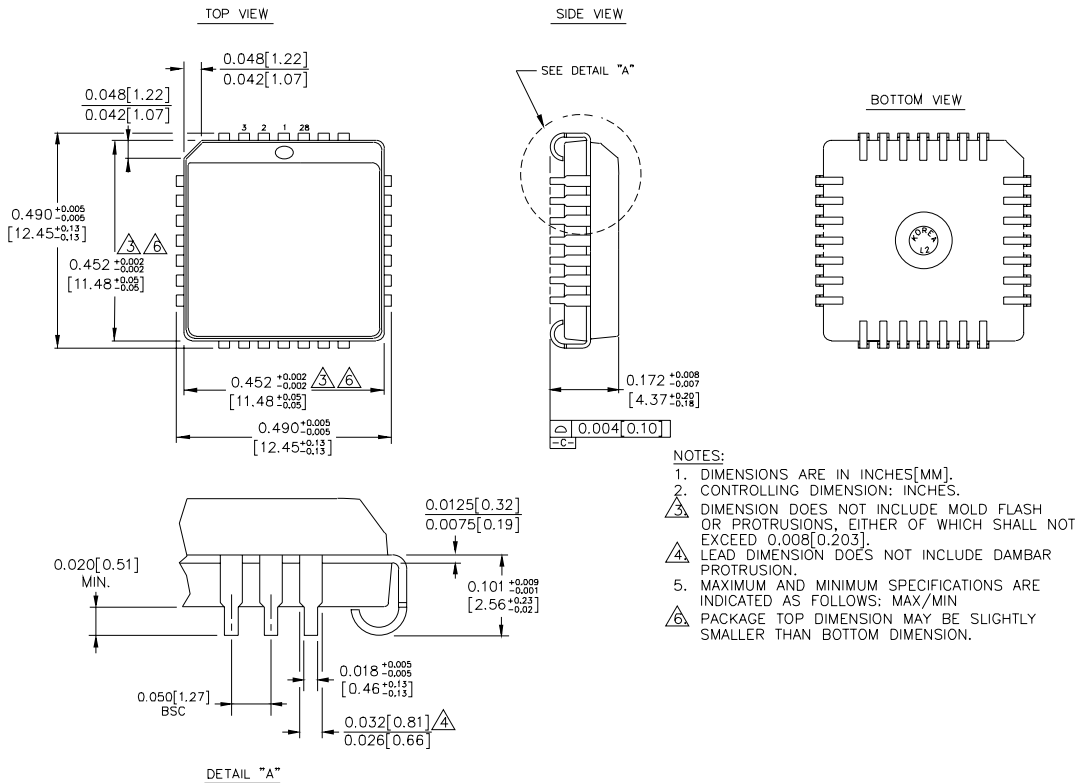


Figure 1

**28-PIN PLCC (J28-1)**



Rev. 03

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