

**Features**

- Meets jitter requirements of Telcordia GR-253-CORE for OC-48, OC-12, and OC-3 rates
- Meets jitter requirements of ITU-T G.813 for STM-16, STM-4 and STM-1 rates
- Provides four LVPECL differential output clocks at 77.76 MHz
- Provides a CML differential clock programmable to 19.44 MHz, 38.88 MHz, 77.76 MHz and 155.52 MHz
- Provides a single-ended CMOS clock at 19.44 MHz
- Provides enable/disable control of output clocks
- Accepts a CMOS reference at 19.44 MHz
- 3.3 V supply

**Applications**

- SONET/SDH line cards
- Network Element timing cards

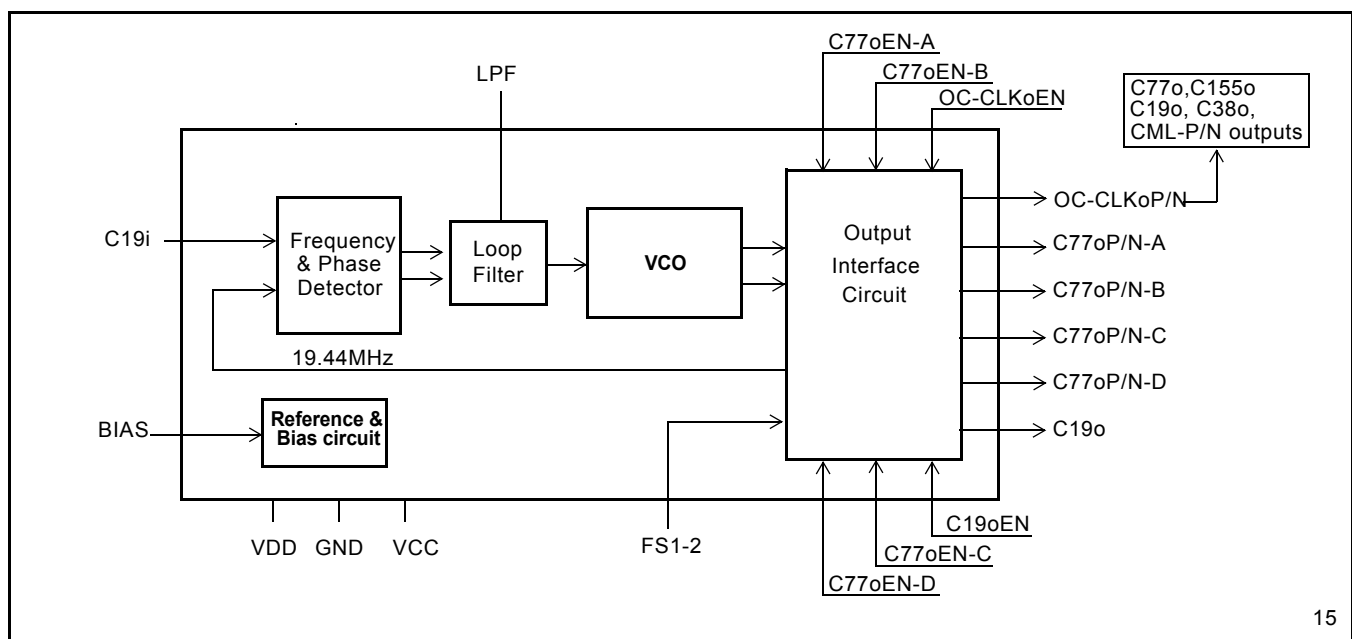
**Ordering Information**

|                       |              |       |
|-----------------------|--------------|-------|
| ZL30406QGC            | 64 Pin TQFP  | Trays |
| ZL30406QGC1           | 64 Pin TQFP* | Trays |
| *Pb Free Matte Tin    |              |       |
| <b>-40°C to +85°C</b> |              |       |

**Description**

The ZL30406 is an analog phase-locked loop (APLL) designed to provide rate conversion and jitter attenuation for SDH (Synchronous Digital Hierarchy) and SONET (Synchronous Optical Network) networking equipment. The ZL30406 generates very low jitter clocks that meet the jitter requirements of Telcordia GR-253-CORE OC-48, OC-12, OC-3, OC-1 rates and ITU-T G.813 STM-16, STM-4 and STM-1 rates.

The ZL30406 accepts a CMOS compatible reference at 19.44 MHz and generates four LVPECL differential output clocks at 77.76 MHz, a CML differential clock programmable to 19.44 MHz, 38.88 MHz, 77.76 MHz and 155.52 MHz and a single-ended CMOS clock at 19.44 MHz. The output clocks can be individually enabled or disabled.


**Figure 1 - Functional Block Diagram**

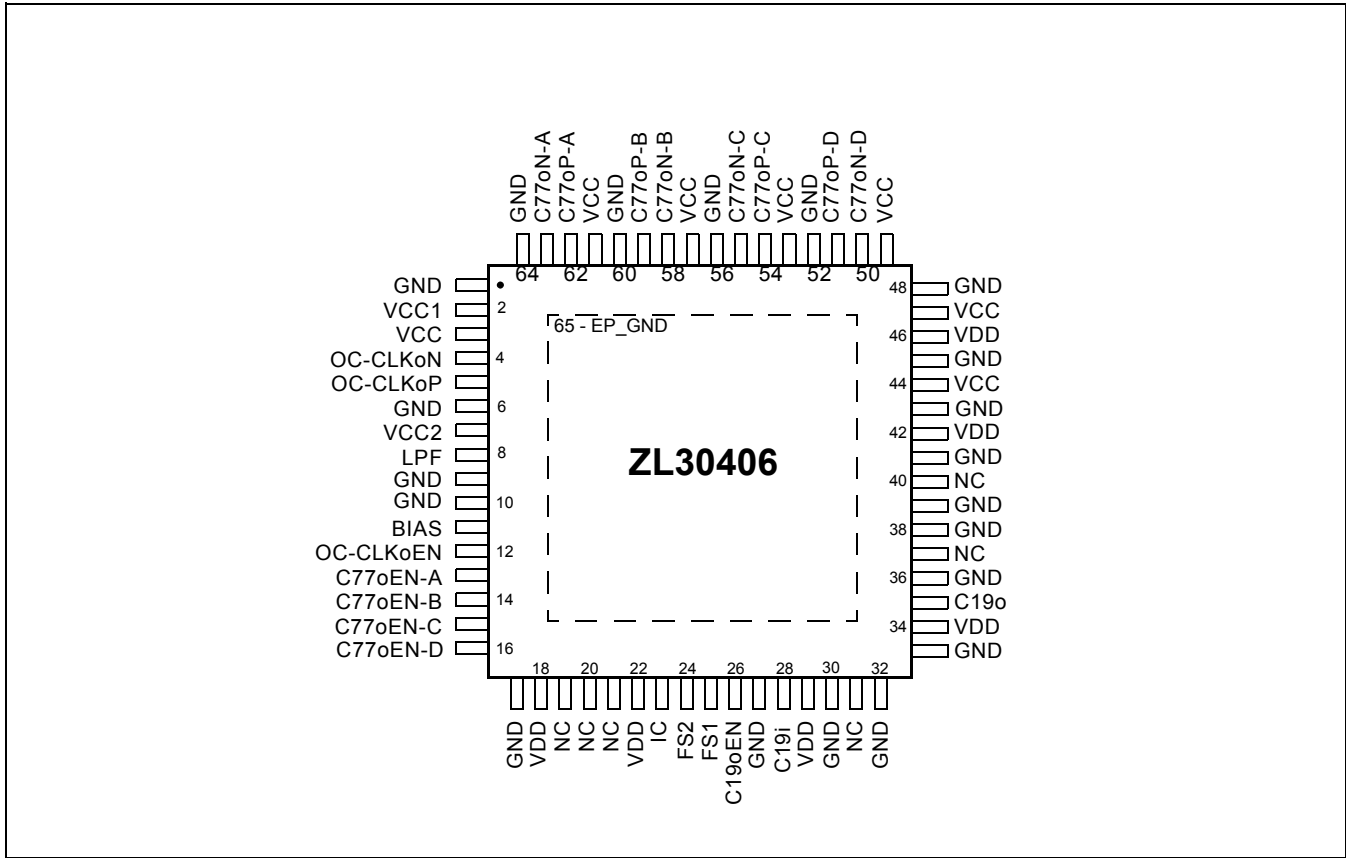


Figure 2 - TQFP 64 pin (Top View)

Pin Description

Pin Description Table

| Pin # | Name     | Description   |
|-------|----------|---|
| 1     | GND      | <b>Ground.</b> 0 volt.  |
| 2     | VCC1     | <b>Positive Analog Power Supply.</b> +3.3 V ±10%  |
| 3     | VCC      | <b>Positive Analog Power Supply.</b> +3.3 V ±10%  |
| 4     | OC-CLKoN | <b>SONET/SDH Clock (CML Output).</b> These outputs provide a programmable differential CML clock at 19.44 MHz, 38.88 MHz, 77.76 MHz and 155.52 MHz. The output frequency is selected with FS2 and FS1 pins. |
| 5     | OC-CLKoP |   |
| 6     | GND      | <b>Ground.</b> 0 volt   |
| 7     | VCC2     | <b>Positive Analog Power Supply.</b> +3.3 V ±10%  |
| 8     | LPF      | Low Pass Filter (Analog). Connect to this pin external RC network (R <sub>F</sub> and C <sub>F</sub> ) for the low pass filter.   |
| 9     | GND      | <b>Ground.</b> 0 volt   |
| 10    | GND      | <b>Ground.</b> 0 volt   |
| 11    | BIAS     | <b>Bias.</b> See Figure 11 for the recommended bias circuit.  |

Pin Description Table (continued)

| Pin #    | Name       | Description   |
|----------|------------|---|
| 12       | OC-CLKoEN  | <b>SONET/SDH Clock Enable (CMOS Input).</b> If tied high this control pin enables the OC-CLKoP/N differential driver. Pulling this input low disables the output clock without deactivating differential drivers. |
| 13       | C77oEN-A   | <b>C77 Clock Output Enable A (CMOS Input).</b> If tied high this control pin enables the C77oP/N-A output clock. Pulling this input low disables the output clock without deactivating differential drivers.      |
| 14       | C77oEN-B   | <b>C77 Clock Output Enable B (CMOS Input).</b> If tied high this control pin enables the C77oP/N-B output clock. Pulling this input low disables the output clock without deactivating differential drivers.      |
| 15       | C77oEN-C   | <b>C77 Clock Output Enable C (CMOS Input).</b> If tied high this control pin enables the C77oP/N-C output clock. Pulling this input low disables the output clock without deactivating differential drivers.      |
| 16       | C77oEN-D   | <b>C77 Clock Output Enable D (CMOS Input).</b> If tied high this control pin enables the C77oP/N-D output clock. Pulling this input low disables the output clock without deactivating differential drivers.      |
| 17       | GND        | <b>Ground.</b> 0 volt   |
| 18       | VDD        | <b>Positive Digital Power Supply.</b> +3.3 V $\pm$ 10%  |
| 19       | NC         | No internal bonding Connection. Leave unconnected.  |
| 20       | NC         | No internal bonding Connection. Leave unconnected.  |
| 21       | NC         | No internal bonding Connection. Leave unconnected.  |
| 22       | VDD        | <b>Positive Digital Power Supply.</b> +3.3 V $\pm$ 10%  |
| 23       | IC         | <b>Internal Connection.</b> Connect this pin to Ground (GND).   |
| 24<br>25 | FS2<br>FS1 | <b>Frequency Select 2-1 (CMOS Input).</b> These inputs program the clock frequency on the OC-CLKo output. The possible output frequencies are 19.44 MHz (00), 38.88 MHz (01), 77.76 MHz (10), 155.52 MHz (11).    |
| 26       | C19oEN     | <b>C19o Output Enable (CMOS Input).</b> If tied high this control pin enables the C19o output clock. Pulling this pin low forces output driver into a high impedance state.                                       |
| 27       | GND        | <b>Ground.</b> 0 volt   |
| 28       | C19i       | <b>C19 Reference Input (CMOS Input).</b> This pin is a single-ended input reference source used for synchronization. This pin accepts 19.44 MHz.  |
| 29       | VDD        | <b>Positive Digital Power Supply.</b> +3.3 V $\pm$ 10%  |
| 30       | GND        | <b>Ground.</b> 0 volt   |
| 31       | NC         | No internal bonding Connection. Leave unconnected.  |
| 32       | GND        | <b>Ground.</b> 0 volt.  |
| 33       | GND        | <b>Ground.</b> 0 volt   |
| 34       | VDD        | <b>Positive Digital Power Supply.</b> +3.3 V $\pm$ 10%  |
| 35       | C19o       | <b>C19 Clock Output (CMOS Output).</b> This pin provides a single-ended CMOS clock at 19.44 MHz.  |

Pin Description Table (continued)

| Pin #    | Name               | Description   |
|----------|--------------------|---|
| 36       | GND                | <b>Ground.</b> 0 volt   |
| 37       | NC                 | No internal bonding Connection. Leave unconnected.  |
| 38       | GND                | <b>Ground.</b> 0 volt   |
| 39       | GND                | <b>Ground.</b> 0 volt   |
| 40       | NC                 | No internal bonding Connection. Leave unconnected.  |
| 41       | GND                | <b>Ground.</b> 0 volt   |
| 42       | VDD                | <b>Positive Digital Power Supply.</b> +3.3 V $\pm$ 10%  |
| 43       | GND                | <b>Ground.</b> 0 volt   |
| 44       | VCC                | <b>Positive Analog Power Supply.</b> +3.3 V $\pm$ 10%   |
| 45       | GND                | <b>Ground.</b> 0 volt   |
| 46       | VDD                | <b>Positive Digital Power Supply.</b> +3.3 V $\pm$ 10%  |
| 47       | VCC                | <b>Positive Analog Power Supply.</b> +3.3 V $\pm$ 10%   |
| 48       | GND                | <b>Ground.</b> 0 volt   |
| 49       | VCC                | <b>Positive Analog Power Supply.</b> +3.3 V $\pm$ 10%.  |
| 50<br>51 | C77oN-D<br>C77oP-D | <b>C77 Clock Output (LVPECL Output).</b> These outputs provide a differential LVPECL clock at 77.76 MHz. Unused LVPECL port should be left unterminated to decrease supply current. |
| 52       | GND                | <b>Ground.</b> 0 volt   |
| 53       | VCC                | <b>Positive Analog Power Supply.</b> +3.3 V $\pm$ 10%.  |
| 54<br>55 | C77oP-C<br>C77oN-C | <b>C77 Clock Output (LVPECL Output).</b> These outputs provide a differential LVPECL clock at 77.76 MHz. Unused LVPECL port should be left unterminated to decrease supply current. |
| 56       | GND                | <b>Ground.</b> 0 volt   |
| 57       | VCC                | <b>Positive Analog Power Supply.</b> +3.3 V $\pm$ 10%.  |
| 58<br>59 | C77oN-B<br>C77oP-B | <b>C77 Clock Output (LVPECL Output).</b> These outputs provide a differential LVPECL clock at 77.76 MHz. Unused LVPECL port should be left unterminated to decrease supply current. |
| 60       | GND                | <b>Ground.</b> 0 volt   |
| 61       | VCC                | <b>Positive Analog Power Supply.</b> +3.3 V $\pm$ 10%.  |
| 62<br>63 | C77oP-A<br>C77oN-A | <b>C77 Clock Output (LVPECL Output).</b> These outputs provide a differential LVPECL clock at 77.76 MHz. Unused LVPECL port should be left unterminated to decrease supply current. |
| 64       | GND                | <b>Ground.</b> 0 volt   |
| 65       | EP_GND             | <b>Exposed die Pad Ground.</b> 0 volt (connect to GND)  |

## 1.0 Functional Description

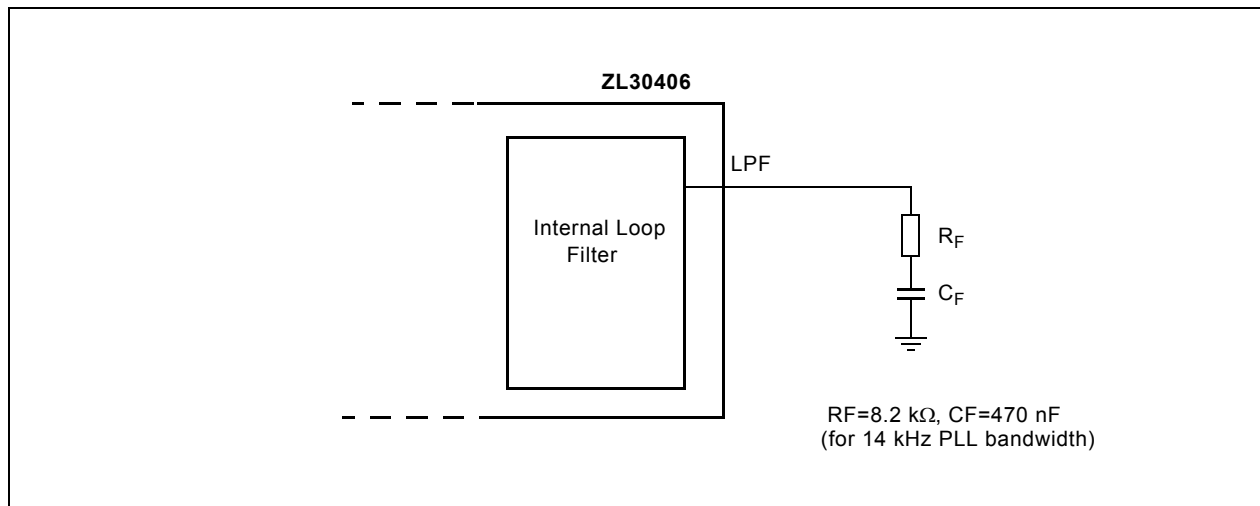
The ZL30406 is an analog phased-locked loop which provides rate conversion and jitter attenuation for SONET/SDH OC-48/STM-16, OC-12/STM-4 and OC-3/STM-1 applications. A functional block diagram of the ZL30406 is shown in Figure 1 and a brief description is presented in the following sections.

### 1.1 Frequency/Phase Detector

The Frequency/Phase Detector compares the frequency/phase of the input reference signal with the feedback signal from the Frequency Divider circuit and provides an error signal corresponding to the frequency/phase difference between the two. This error signal is passed to the Loop Filter circuit and averaged to control the VCO frequency.

### 1.2 Loop Filter

The Loop Filter is a low pass filter. This low pass filter ensures that the network jitter requirements are met for an input reference frequency of 19.44 MHz. The corner frequency of the Loop Filter is configurable with an external capacitor and resistor connected to the LPF pin and ground as shown below.



**Figure 3 - External Loop Filter**

### 1.3 VCO

The voltage-controlled oscillator (VCO) receives the filtered error signal from the Loop Filter, and based on the voltage of the error signal, generates a primary frequency. The VCO output is connected to the Output Interface Circuit that divides VCO frequency and buffers generated clocks.

## 1.4 Output Interface Circuit

The output of the VCO is used by the Output Interface Circuit to provide four LVPECL differential clocks at 77.76 MHz, one programmable CML differential clock (19.44 MHz, 38.88 MHz, 77.76 MHz, 155.52 MHz) controlled with FS1-2 pins and a single-ended 19.44 MHz output clock. This block provides also a 19.44 MHz feedback clock that closes PLL loop. Each output clock can be enabled or disabled individually with the associated Output Enable pin.

| Output Clocks | Output Enable Pins |
|---------------|--------------------|
| C77oP/N-A     | C77oEN-A           |
| C77oP/N-B     | C77oEN-B           |
| C77oP/N-C     | C77oEN-C           |
| C77oP/N-D     | C77oEN-D           |
| OC-CLKoP/N    | OC-CLKoEN          |
| C19o          | C19oEN             |

**Table 1 - Output Enable Control**

To reduce power consumption and achieve the lowest possible intrinsic jitter the unused output clocks must be disabled. If any of the LVPECL outputs are disabled they must be left open without any terminations.

The output clock frequency of the OC-CLKo CML differential output clock is selected with FS1-2 pins as shown in the following table.

| FS2 | FS1 | OC-CLKo Frequency |
|-----|-----|-------------------|
| 0   | 0   | 19.44 MHz         |
| 0   | 1   | 38.88 MHz         |
| 1   | 0   | 77.76 MHz         |
| 1   | 1   | 155.52 MHz        |

**Table 2 - OC-CLKo Clock Frequency Selection**

## 2.0 Applications

### 2.1 Ultra-Low Jitter SONET/SDH Equipment Clocks

The ZL30406 functionality and performance complements the entire family of the Zarlink's advanced network synchronization PLLs. Its superior jitter filtering characteristics exceed requirements of SONET/SDH optical interfaces operating at OC-48/STM-16 rate (2.5 Gbit/s). The ZL30406 in combination with the MT90401 or the ZL30407 (SONET/SDH Network Element PLLs) provides the core building blocks for high quality equipment clocks suitable for network synchronization (see Figure 4).

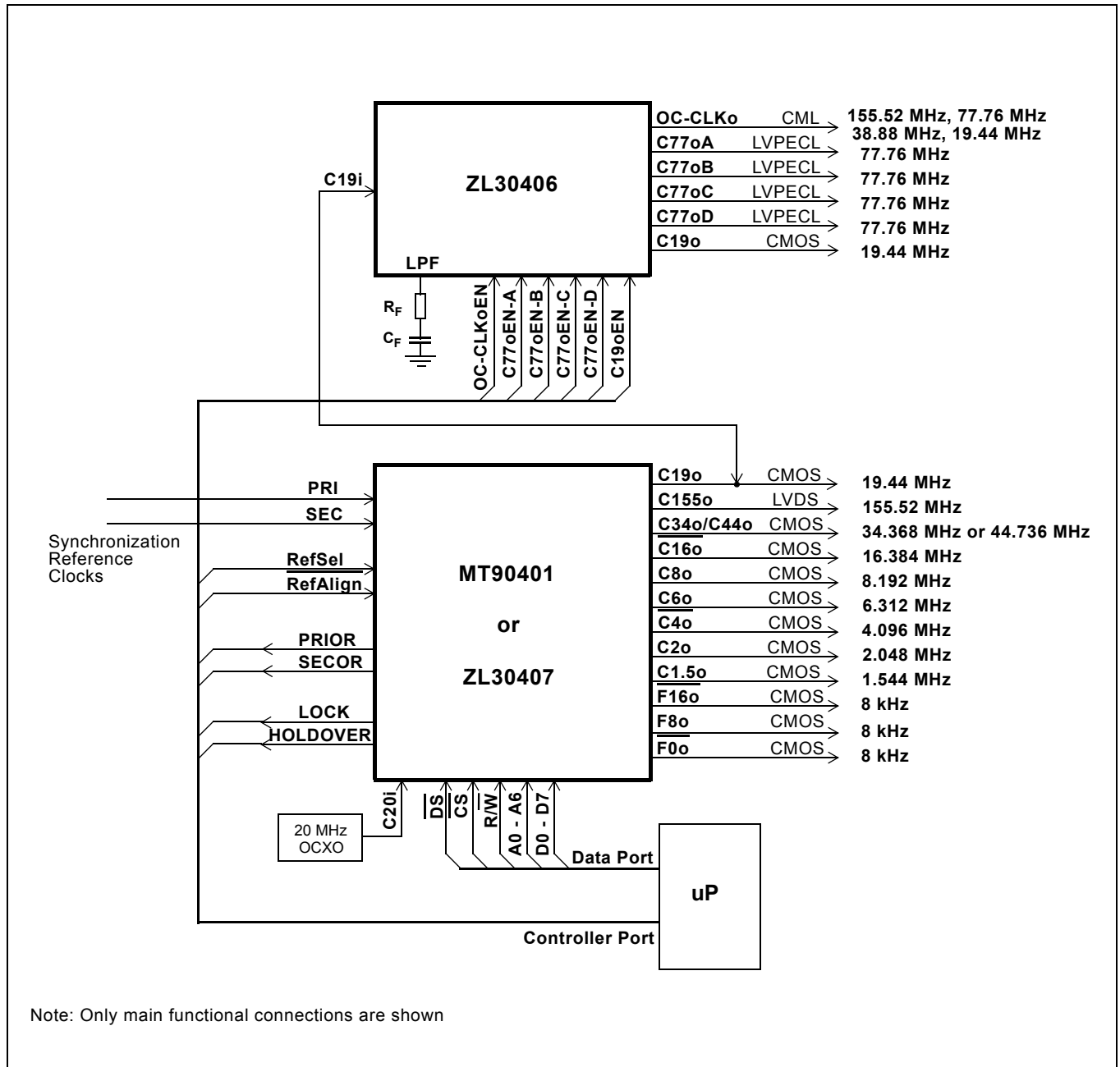


Figure 4 - SONET/SDH Equipment Timing Card

The ZL30406 in combination with the MT9046 provides an optimum solution for SONET/SDH line cards (see Figure 5).

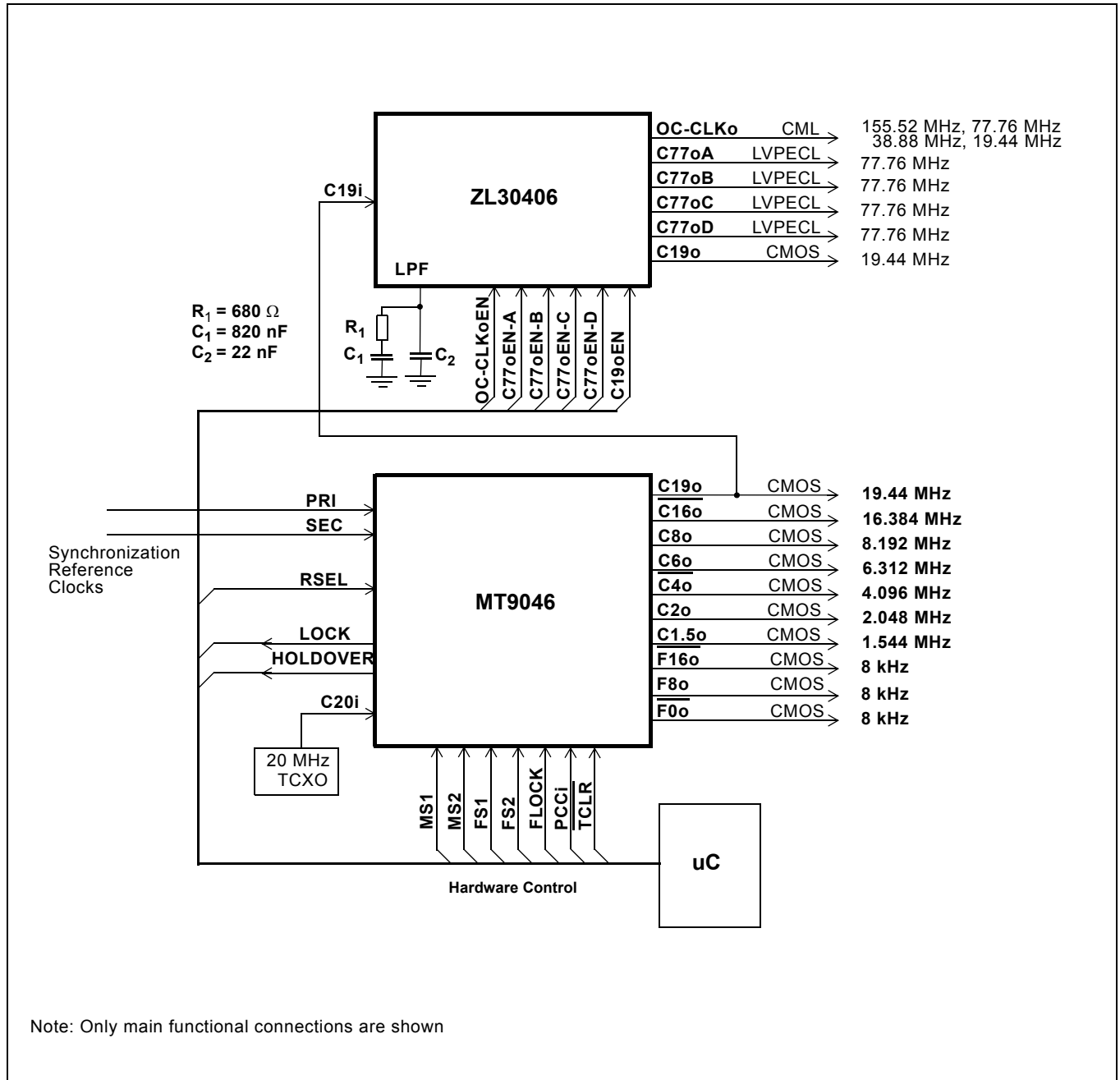


Figure 5 - SONET/SDH Line Card



## 2.2 Recommended Interface circuit

### 2.2.1 LVPECL to LVPECL Interface

The C77oP/N-A, C77oP/N-B, C77oP/N-B, and C77oP/N-D outputs provide differential LVPECL clocks at 77.76 MHz. The LVPECL output drivers require a 50 Ω termination connected to the VCC-2V source for each output terminal at the terminating end as shown below. The terminating resistors should be placed as close as possible to the LVPECL receiver.

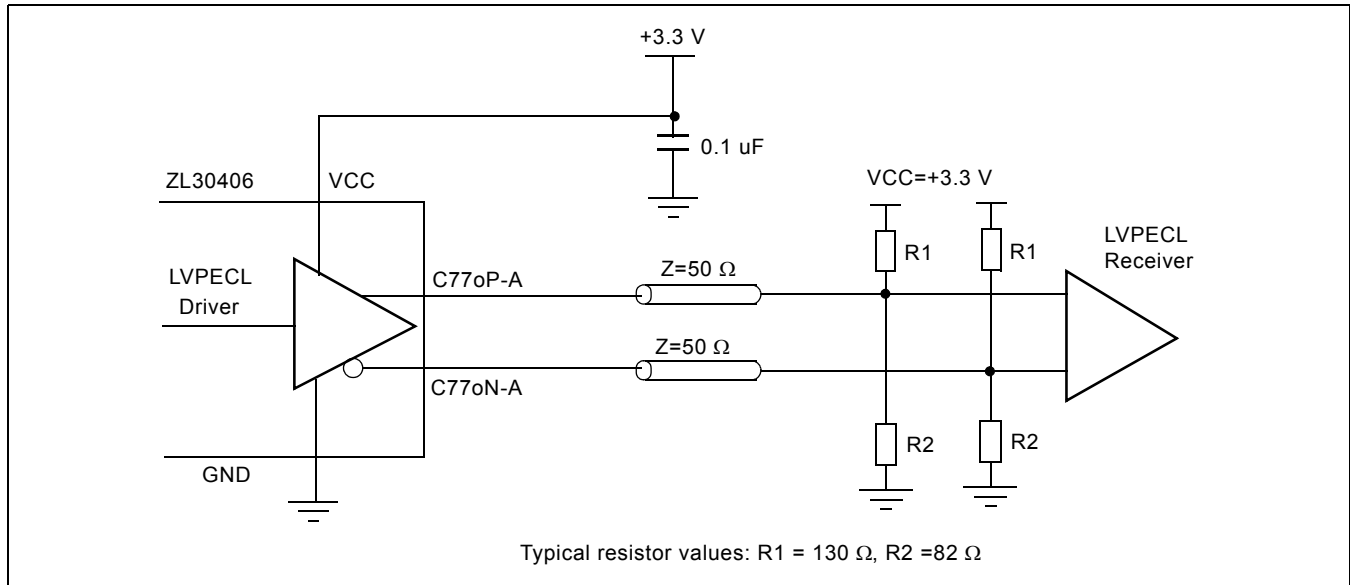


Figure 6 - LVPECL to LVPECL Interface

### 2.2.2 CML to CML Interface

The CMLP/N output provides a differential CML/LVDS compatible clock at 19.44 MHz, 38.88 MHz, 77.76 MHz, 155.52 MHz selected with FS1-2 pins. The output drivers require a 50 Ω load at the terminating end if the receiver is CML type.

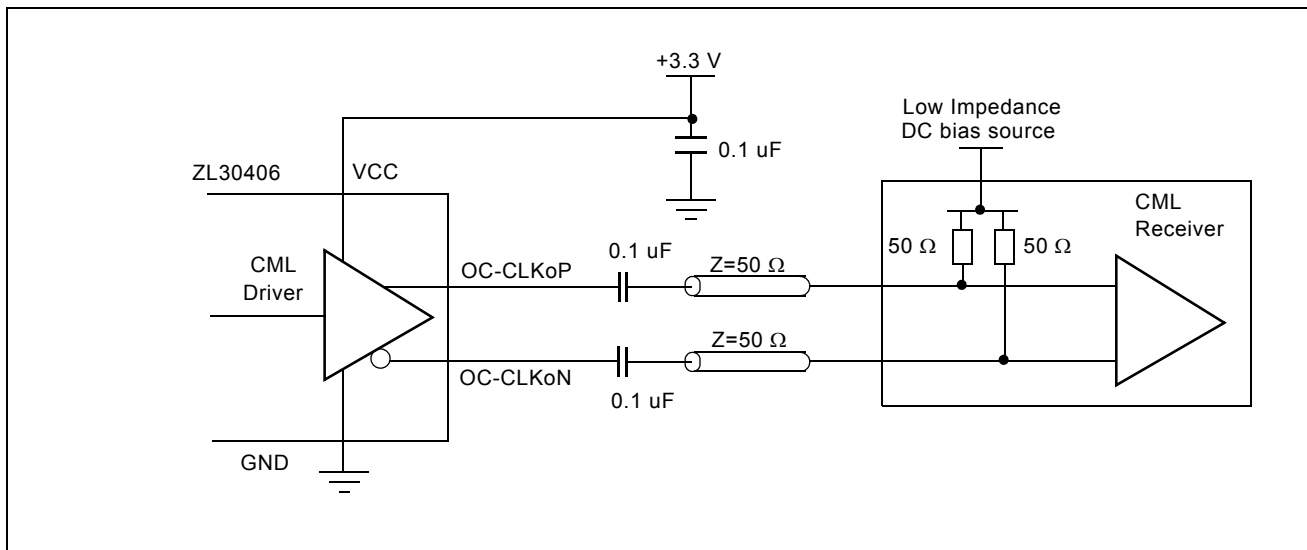
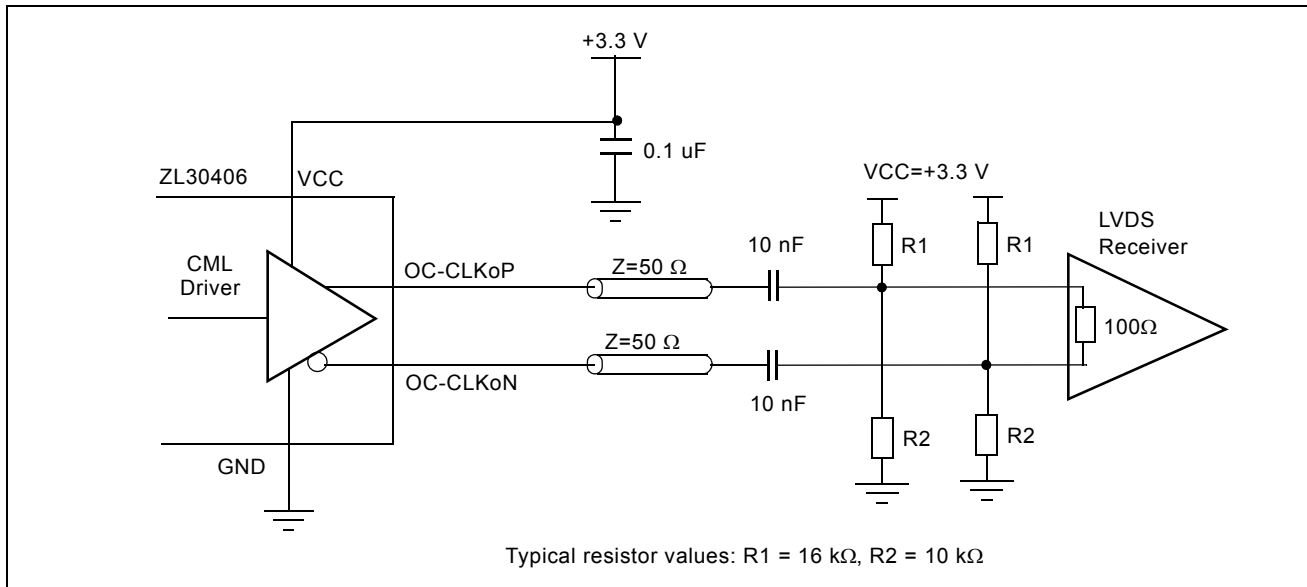


Figure 7 - CML to CML Interface

### 2.2.3 CML to LVDS Interface

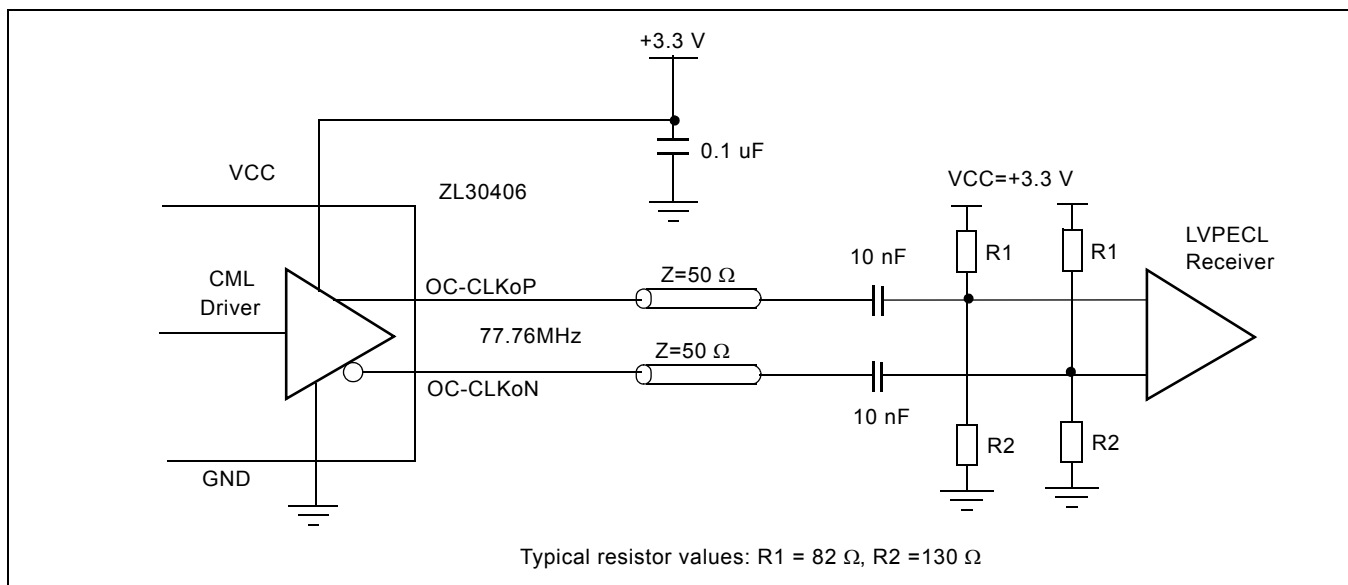
To configure the driver as an LVDS driver, external biasing resistors are required to set up the common mode voltage as specified by ANSI/TIA/EIA-644 LVDS standard. The standard specifies the  $V_{CM}$  (common mode voltage) as minimum 1.125 V, typical 1.2 V, and maximum 1.375 V. The following figure provides a recommendation for LVDS applications.



**Figure 8 - LVDS Termination**

### 2.2.4 CML to LVPECL Interface

In the case when more than four 77.76 MHz clocks are required to drive LVPECL receivers then the unused OC-CLKo clock (CML output) can be configured to output the 77.76 MHz clock and interface to the LVPECL receiver as is shown in the Figure 9. The terminating resistors should be placed as close as possible to the LVPECL receiver.



**Figure 9 - CML to LVPECL Interface**

### 2.3 Tristating LVPECL Outputs

The ZL30406 has four differential 77.76 MHz LVPECL outputs, which can be used to drive four different OC-3/OC-12/OC-48 devices such as framers, mappers and SERDES. In the case where fewer than four clocks are required, a user can disable unused LVPECL outputs on the ZL30406 by pulling the corresponding enable pins low. When disabled, voltage at the both pins of the differential LVPECL output will be pulled up to  $V_{cc} - 0.7$  V.

For applications requiring the LVPECL outputs to be in a tri-state mode, external AC coupling capacitors can be used as shown in Figure 10. Typically this might be required in hot swappable applications.

Resistors R1 and R2 are required for DC bias of the LVPECL driver. Capacitors C1 and C2 are used as AC coupling capacitors. During disable mode (C77oEN pin pulled low) those capacitors present infinite impedance to the DC signal and to the receiving device this looks like a tristated (High-Z) output. Resistors R3, R4, R5 and R6 are used to terminate the transmission line with 50 ohm impedance and to generate DC bias voltage for the LVPECL receiver. If the LVPECL receiver has an integrated 50 ohm termination and bias source, resistors R3, R4, R5 and R6 should not be populated.

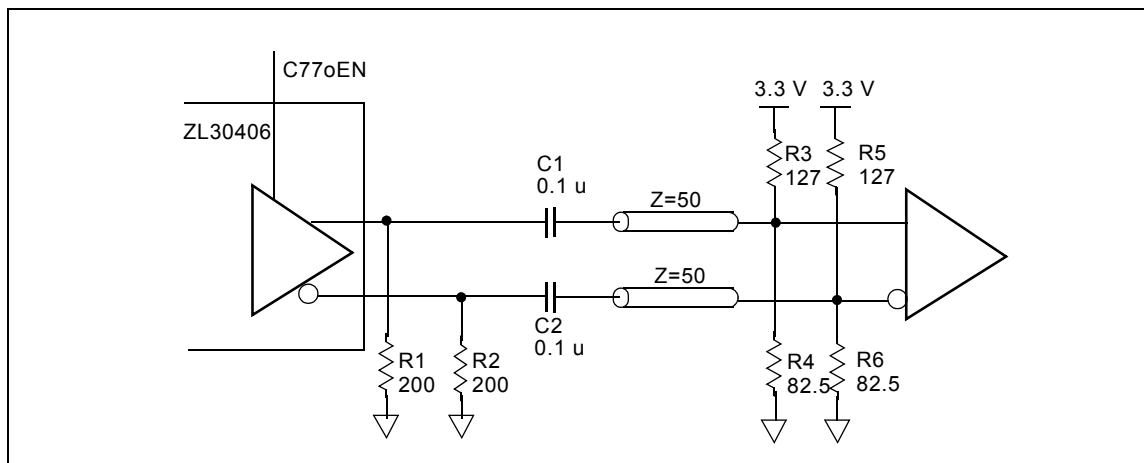
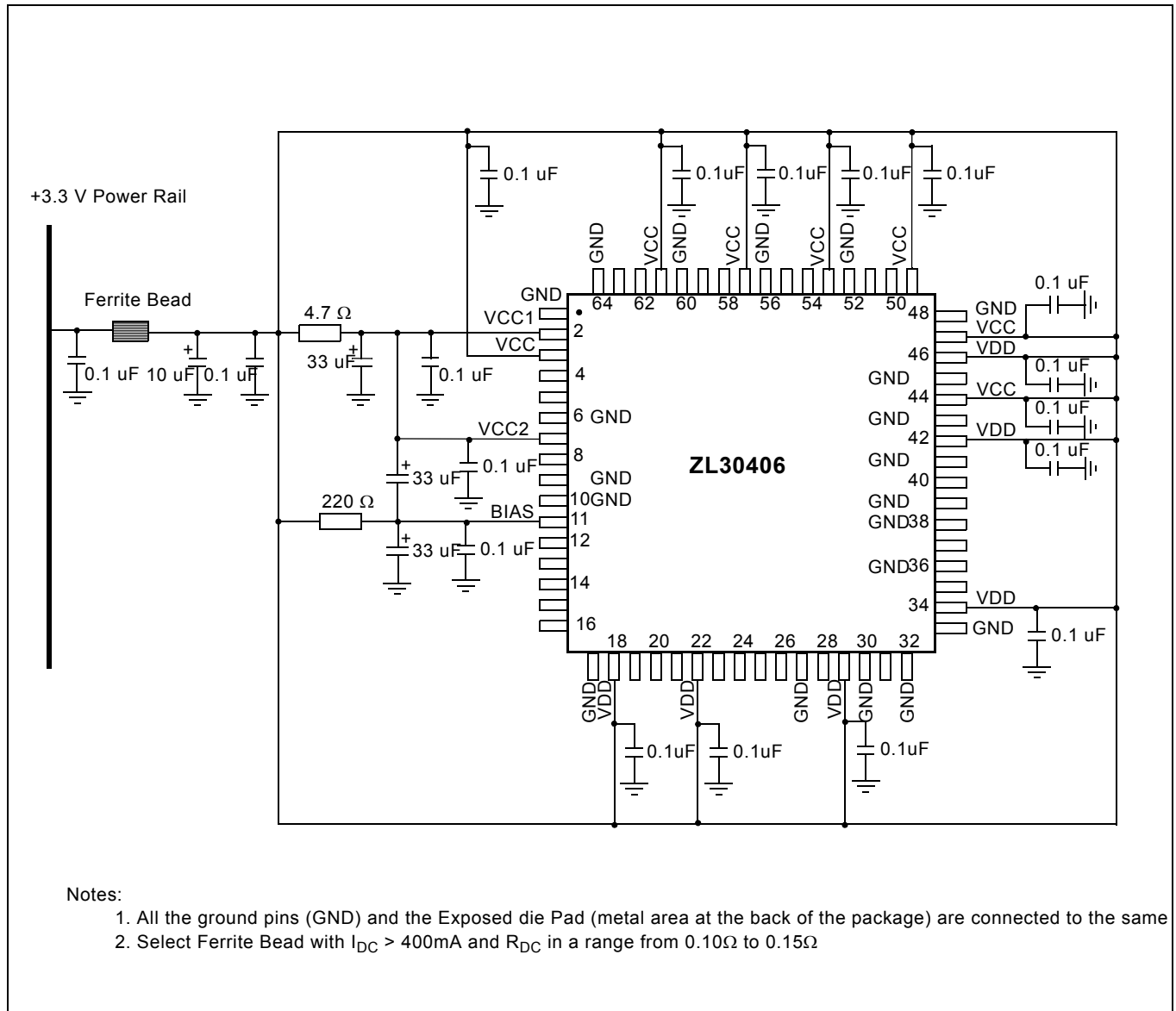


Figure 10 - Tristatable LVPECL Outputs

**2.4 Power Supply and BIAS Circuit Filtering Recommendations**

Figure 11 presents a complete filtering arrangement that is recommended for applications requiring maximum jitter performance. The level of required filtering is subject to further optimization and simplification. Please check Zarlink’s web site for updates.



**Figure 11 - Power Supply and BIAS circuit filtering**

### 3.0 Characteristics

#### Absolute Maximum Ratings<sup>†</sup>

|   | Characteristics           | Sym               | Min. <sup>‡</sup> | Max. <sup>‡</sup>                | Units |
|---|---------------------------|-------------------|-------------------|----------------------------------|-------|
| 1 | Supply voltage            | $V_{DD}, V_{CCR}$ | TBD               | TBD                              | V     |
| 2 | Voltage on any pin        | $V_{PIN}$         | -0.5              | $V_{CC} + 0.5$<br>$V_{DD} + 0.5$ | V     |
| 3 | Current on any pin        | $I_{PIN}$         | -0.5              | 30                               | mA    |
| 4 | ESD Rating                | $V_{ESD}$         |                   | 1500                             | V     |
| 5 | Storage temperature       | $T_{ST}$          | -55               | 125                              | °C    |
| 6 | Package power dissipation | $P_{PD}$          |                   | 1.8                              | W     |

† Voltages are with respect to ground unless otherwise stated.

‡ Exceeding these values may cause permanent damage. Functional operation under these conditions is not implied.

#### Recommended Operating Conditions<sup>†</sup>

|   | Characteristics       | Sym.                              | Min. | Typ. <sup>‡</sup> | Max. | Units | Notes |
|---|-----------------------|-----------------------------------|------|-------------------|------|-------|-------|
| 1 | Operating Temperature | $T_{OP}$                          | -40  | 25                | +85  | °C    |       |
| 2 | Positive Supply       | $V_{DD}, V_{CC}$<br>$V_{CC\_VCO}$ | 3.0  | 3.3               | 3.6  | V     |       |

† Voltages are with respect to ground unless otherwise stated.

‡ Typical figures are for design aid only: not guaranteed and not subject to production testing.

‡

#### DC Electrical Characteristics<sup>†</sup>

|   | Characteristics  | Sym.              | Min.        | Typ. <sup>‡</sup> | Max.        | Units | Notes   |
|---|--|-------------------|-------------|-------------------|-------------|-------|---|
| 1 | Supply Current   | $I_{DD} + I_{CC}$ |             | 140               | 155         | mA    | LVPECL, CML drivers disabled and unterminated |
| 2 | Incremental Supply Current to single LVPECL driver (driver enabled and terminated, see Figure 6) | $I_{LVPECL}$      |             | 40                |             | mA    | Note 1,2                                      |
| 3 | Incremental Supply Current to CML driver (driver enabled and terminated, see Figure 7)           | $I_{CML}$         |             | 24                |             | mA    | Note 3  |
| 4 | CMOS: High-level input voltage   | $V_{IH}$          | $0.7V_{DD}$ |                   | $V_{DD}$    | V     |   |
| 5 | CMOS: Low-level input voltage  | $V_{IL}$          | 0           |                   | $0.3V_{DD}$ | V     |   |
| 6 | CMOS: Input leakage current, C19i  | $I_{IL}$          |             | 1                 |             | uA    | $V_I = V_{DD}$ or 0V                          |

DC Electrical Characteristics<sup>†</sup> (continued)

|    | Characteristics  | Sym.               | Min.          | Typ. <sup>‡</sup> | Max.          | Units | Notes                  |
|----|--|--------------------|---------------|-------------------|---------------|-------|------------------------|
| 7  | CMOS: Input bias current for pulled-down inputs: FS1, FS2, C77oEN-A, C77oEN-C, C77oEN-D, OC-CLKoEN | $I_{B-PU}$         |               | 300               |               | uA    | $V_I = V_{DD}$         |
| 8  | CMOS: Input bias current for pulled-up inputs: , C77oEN-B, C19o_EN                                 | $I_{B-PD}$         |               | 90                |               | uA    | $V_I = 0V$             |
| 9  | CMOS: High-level output voltage  | $V_{OH}$           | 2.4           |                   |               | V     | $I_{OH} = 8\text{ mA}$ |
| 10 | CMOS: Low-level output voltage   | $V_{OL}$           |               |                   | 0.4           | V     | $I_{OL} = 4\text{ mA}$ |
| 11 | CMOS: C19o output rise time (18pF)   | $T_R$              |               | 1.8               | 3.3           | ns    | 18 pF load             |
| 12 | CMOS: C19o output fall time (18pF)   | $T_F$              |               | 1.1               | 1.4           | ns    | 18 pF load             |
| 13 | LVPECL: Differential output voltage  | $ V_{OD\_LVPECL} $ |               | 1.30              |               | V     | Note 2                 |
| 14 | LVPECL: Offset voltage   | $V_{OS\_LVPECL}$   | $V_{CC}-1.38$ | $V_{CC}-1.27$     | $V_{CC}-1.15$ | V     | Note 2                 |
| 15 | LVPECL: Output rise/fall times   | $T_{RF}$           |               | 260               |               | ps    | Note 2                 |
| 16 | CML: Differential output voltage   | $ V_{OD\_CML} $    |               | 0.70              |               | V     | Note 3                 |
| 17 | CML: Offset voltage (Also referred to as common mode voltage)                                      | $V_{OS\_CML}$      | $V_{CC}-0.58$ | $V_{CC}-0.54$     | $V_{CC}-0.50$ | V     | Note 3                 |
| 18 | CML: Output rise/fall times  | $T_{RF}$           |               | 120               |               | ps    | Note 3                 |

<sup>†</sup> : Voltages are with respect to ground unless otherwise stated.

<sup>‡</sup> : Typical figures are for design aid only: not guaranteed and not subject to production testing.

Note: Supply voltage and operating temperature are as per Recommended Operating Conditions

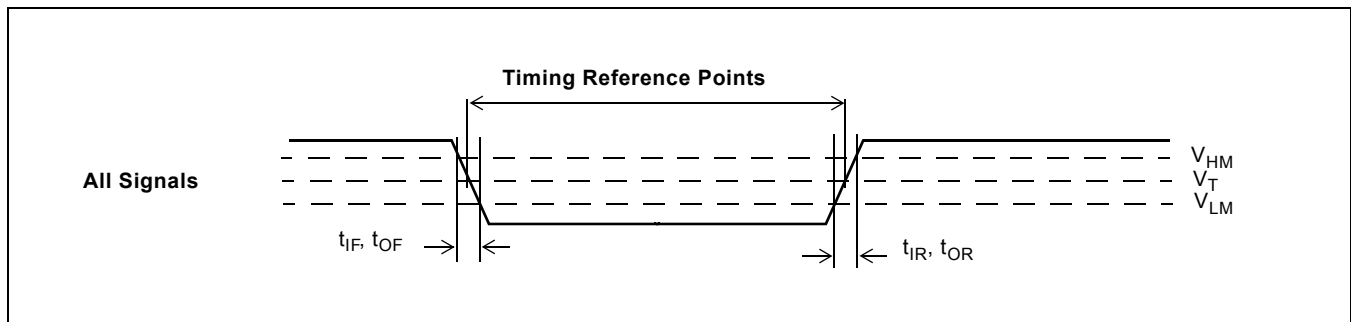
Note 1: The  $I_{LVPECL}$  current is determined by termination network connected to LVPECL outputs. More than 25% of this current flows outside the chip and it does not contribute to the internal power dissipation.

Note 2: LVPECL outputs terminated with  $Z_T = 50\ \Omega$  resistors biased to  $V_{CC}-2V$  (see Figure 6)

Note 3: CML outputs terminated with  $Z_T = 50\ \Omega$  resistors connected to low impedance DC bias voltage source (see Figure 7)

**AC Electrical Characteristics<sup>†</sup> - Output Timing Parameters Measurement Voltage Levels**

|   | Characteristics                      | Sym   | CMOS <sup>‡</sup> | LVPECL              | CML              | Units |
|---|--------------------------------------|---|-------------------|---------------------|------------------|-------|
| 1 | Threshold Voltage                    | $V_{T-CMOS}$<br>$V_{T-LVPECL}$<br>$V_{T-CML}$ | $0.5V_{DD}$       | $0.5V_{OD\_LVPECL}$ | $0.5V_{OD\_CML}$ | V     |
| 2 | Rise and Fall Threshold Voltage High | $V_{HM}$                                      | $0.7V_{DD}$       | $0.8V_{OD\_LVPECL}$ | $0.8V_{OD\_CML}$ | V     |
| 3 | Rise and Fall Threshold Voltage Low  | $V_{LM}$                                      | $0.3V_{DD}$       | $0.2V_{OD\_LVPECL}$ | $0.2V_{OD\_CML}$ | V     |



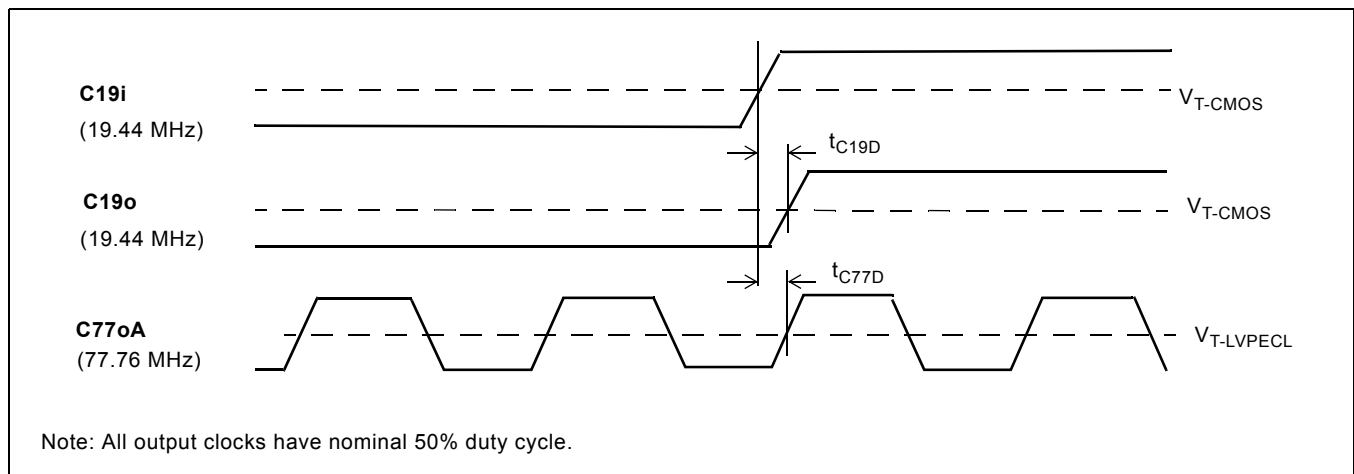
**Figure 12 - Output Timing Parameter Measurement Voltage Levels**

**AC Electrical Characteristics<sup>†</sup> - C19i Input to C19o and C77o Output Timing**

|   | Characteristics     | Sym.       | Min. | Typ. <sup>‡</sup> | Max. | Units | Notes |
|---|---------------------|------------|------|-------------------|------|-------|-------|
| 1 | C19i to C19o delay  | $t_{C19D}$ |      | 6.7               |      | ns    |       |
| 2 | C19i to C77oA delay | $t_{C77D}$ |      | -4                |      | ns    |       |

<sup>†</sup> Supply voltage and operating temperature are as per Recommended Operating Conditions.

<sup>‡</sup> Typical figures are for design aid only; not guaranteed and not subject to production testing.



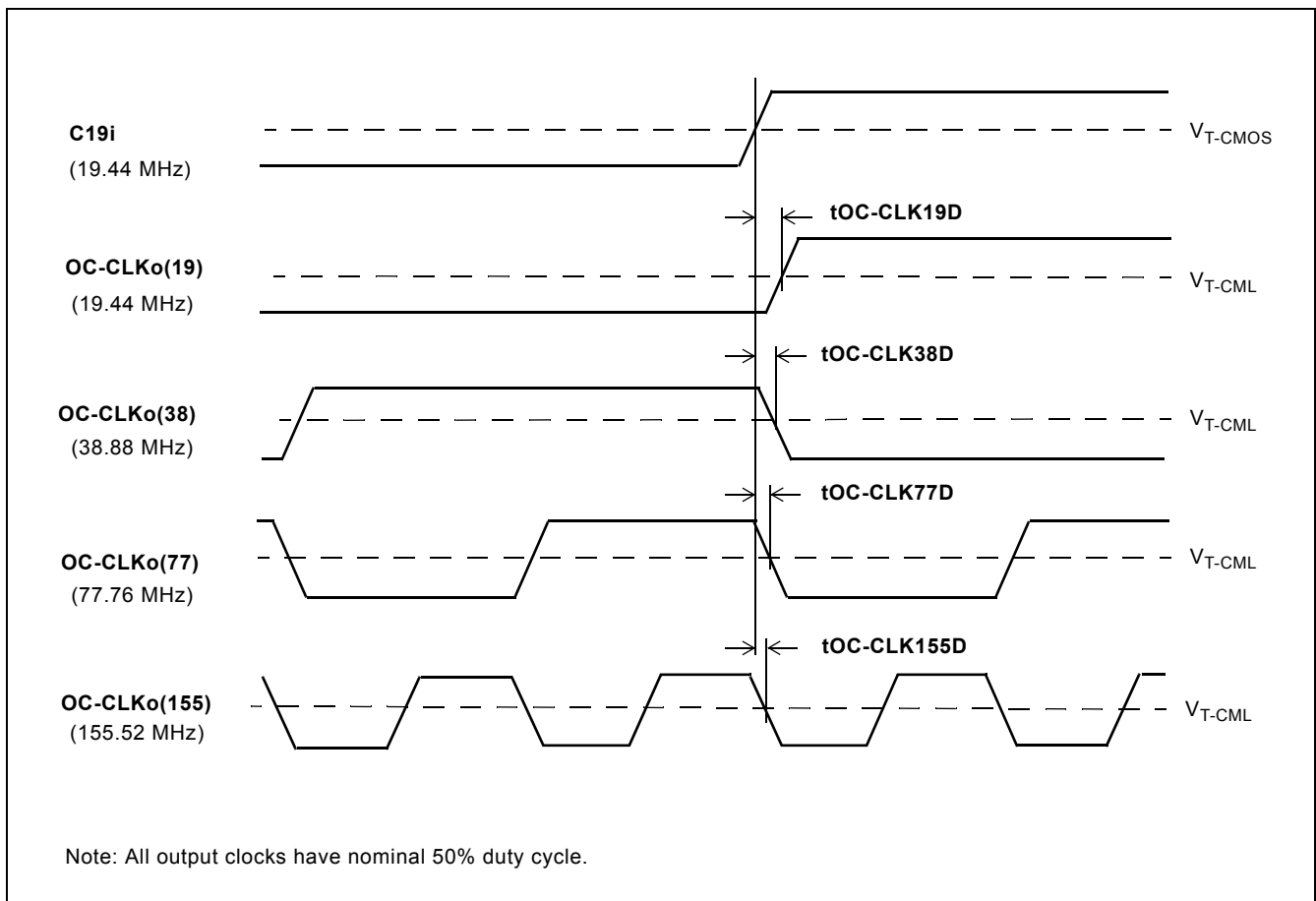
**Figure 13 - C19i Input to C19o and C77o Output Timing**

**AC Electrical Characteristics<sup>†</sup> - C19i Input to OC-CLKo Output Delay Timing (CML)**

|   | Characteristics            | Sym.             | Min. | Typ. <sup>‡</sup> | Max. | Units | Notes |
|---|----------------------------|------------------|------|-------------------|------|-------|-------|
| 1 | C19i to OC-CLKo(19) delay  | $t_{OC-CLK19D}$  |      | 3.2               |      | ns    |       |
| 2 | C19i to OC-CLKo(38) delay  | $t_{OC-CLK38D}$  |      | 3.0               |      | ns    |       |
| 3 | C19i to OC-CLKo(77) delay  | $t_{OC-CLK77D}$  |      | 2.7               |      | ns    |       |
| 4 | C19i to OC-CLKo(155) delay | $t_{OC-CLK155D}$ |      | 2.4               |      | ns    |       |

<sup>†</sup> Supply voltage and operating temperature are as per Recommended Operating Conditions.

<sup>‡</sup> Typical figures are for design aid only; not guaranteed and not subject to production testing.



**Figure 14 - C19i Input to OC-CLKo Output Timing**

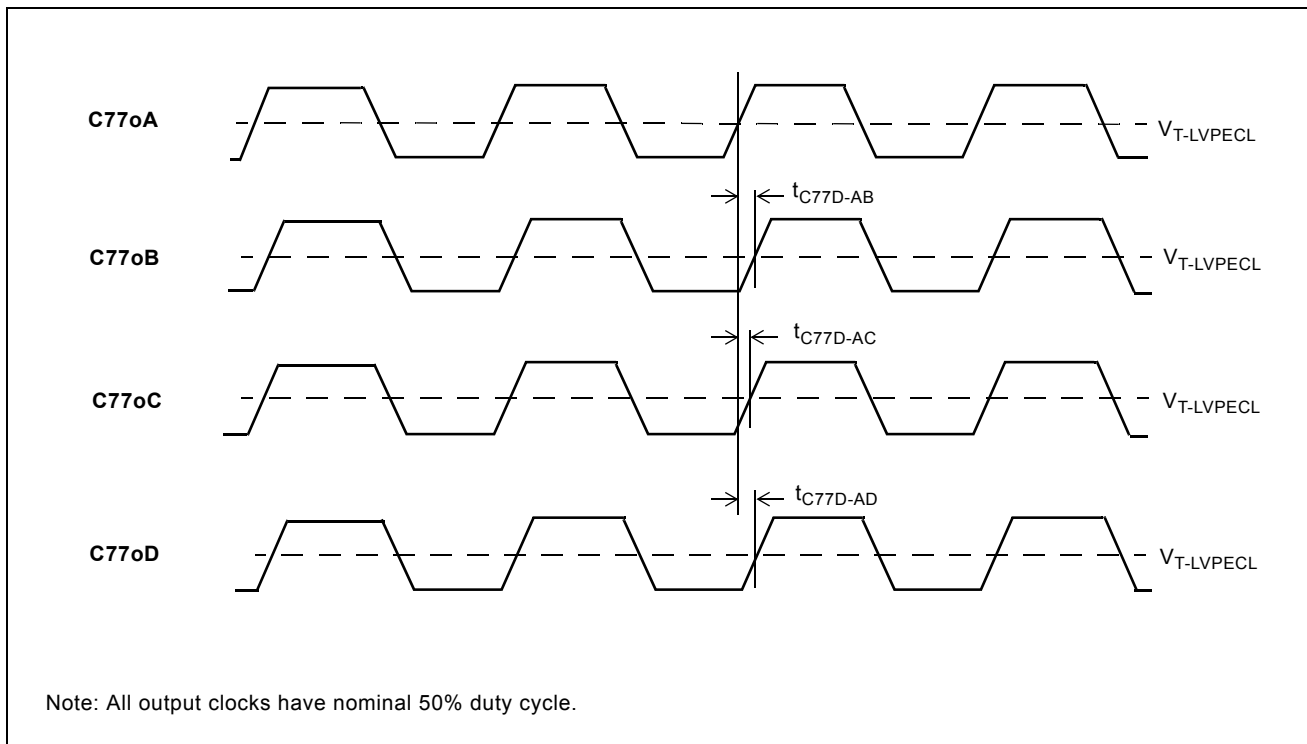


**AC Electrical Characteristics† - C77 Clocks Output Timing**

|   | Characteristics | Sym.          | Min. | Typ.‡ | Max. | Units | Notes |
|---|-----------------|---------------|------|-------|------|-------|-------|
| 1 | C77oA to C77oB  | $t_{C77D-AB}$ |      | 100   |      | ps    |       |
| 2 | C77oA to C77oC  | $t_{C77D-AC}$ |      | 100   |      | ps    |       |
| 3 | C77oA to C77oD  | $t_{C77D-AD}$ |      | 100   |      | ps    |       |

† Supply voltage and operating temperature are as per Recommended Operating Conditions.

‡ Typical figures are for design aid only: not guaranteed and not subject to production testing.



**Figure 15 - C77oB, C77oC, C77oD Outputs Timing**

**Performance Characteristics - Functional-** ( $V_{CC} = 3.3V \pm 10\%$ ;  $T_A = -40$  to  $85^\circ C$ )

|   | Characteristics | Min.       | Max. | Units | Notes |
|---|-----------------|------------|------|-------|-------|
| 1 | Pull-in range   | $\pm 1000$ |      | ppm   |       |
| 2 | Lock Time       |            | 300  | ms    |       |

**Performance Characteristics: Output Jitter Generation - GR-253-CORE conformance** - ( $V_{CC} = 3.3V \pm 10\%$ ;  $T_A = -40$  to  $85^\circ C$ )

| GR-253-CORE Jitter Generation Requirements |                         |                           |                       | ZL30406 Jitter Generation Performance |                   |                   |                   |
|--|-------------------------|---------------------------|-----------------------|---------------------------------------|-------------------|-------------------|-------------------|
|  | Interface (Category II) | Jitter Measurement Filter | Limit in UI           | Equivalent limit in time domain       | Typ. <sup>†</sup> | Max. <sup>‡</sup> | Units             |
| 1  | OC-48<br>STS-48         | 12 kHz - 20 MHz           | 0.1 UIpp              | 40.2                                  | -                 | 16.9              | $\text{ps}_{P-P}$ |
|  |                         |                           | 0.01UI <sub>RMS</sub> | 4.02                                  | 1.3               | 2.1               | $\text{ps}_{RMS}$ |
| 2  | OC-12<br>STS-12         | 12 kHz - 5 MHz            | 0.1 UIpp              | 161                                   | -                 | 9.0               | $\text{ps}_{P-P}$ |
|  |                         |                           | 0.01UI <sub>RMS</sub> | 16.1                                  | 0.7               | 1.3               | $\text{ps}_{RMS}$ |

<sup>†</sup> Typical figures are for design aid only: not guaranteed and not subject to production testing.

<sup>‡</sup> Loop Filter components:  $R_F=8.2\text{ k}\Omega$ ,  $C_F=470\text{ nF}$

**Performance Characteristics: Output Jitter Generation - ETSI EN 300 462-7-1 conformance** - ( $V_{CC} = 3.3V \pm 10\%$ ;  $T_A = -40$  to  $85^\circ C$ )

| EN 300 462-7-1 Jitter Generation Requirements |           |                           |             | ZL30406 Jitter Generation Performance |                   |                   |                   |
|---|-----------|---------------------------|-------------|---------------------------------------|-------------------|-------------------|-------------------|
|   | Interface | Jitter Measurement Filter | Limit in UI | Equivalent limit in time domain       | Typ. <sup>†</sup> | Max. <sup>‡</sup> | Units             |
| 1   | STM-16    | 1 MHz to 20 MHz           | 0.1 UIpp    | 40.2                                  | -                 | 12.6              | $\text{ps}_{P-P}$ |
|   |           |                           | -           | -                                     | 1.0               | 1.5               | $\text{ps}_{RMS}$ |
|   |           | 5 kHz to 20 MHz           | 0.5UIpp     | 201                                   | -                 | 17.1              | $\text{ps}_{P-P}$ |
|   |           |                           | -           | -                                     | 1.3               | 2.2               | $\text{ps}_{RMS}$ |
| 2   | STM-4     | 250 kHz to 5 MHz          | 0.1 UIpp    | 161                                   | -                 | 5.8               | $\text{ps}_{P-P}$ |
|   |           |                           | -           | -                                     | 0.46              | 0.9               | $\text{ps}_{RMS}$ |
|   |           | 1 kHz to 5 MHz            | 0.5 UIpp    | 804                                   | -                 | 29.8              | $\text{ps}_{P-P}$ |
|   |           |                           | -           | -                                     | 2.4               | 3.2               | $\text{ps}_{RMS}$ |

<sup>†</sup> Typical figures are for design aid only: not guaranteed and not subject to production testing.

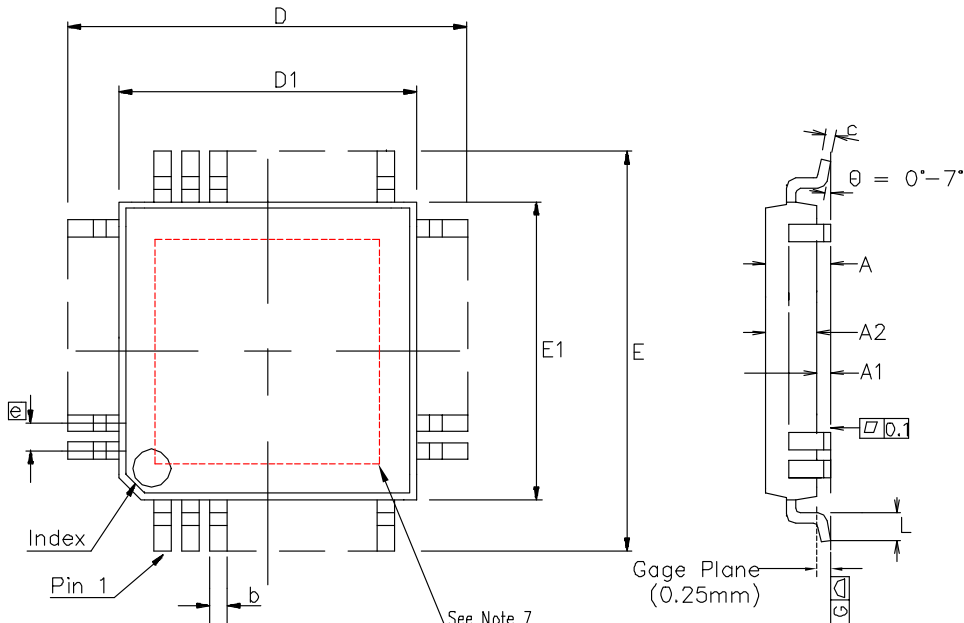
<sup>‡</sup> Loop Filter components:  $R_F=8.2\text{ k}\Omega$ ,  $C_F=470\text{ nF}$

**Performance Characteristics: Output Jitter Generation - G.813 conformance (Option 1 and 2) - ( $V_{CC} = 3.3V$   $\pm 10\%$ ;  $T_A = -40$  to  $85^\circ C$ )**

| G.813 Jitter Generation Requirements |           |                           |             | ZL30406 Jitter Generation Performance |                   |                   |                   |
|--------------------------------------|-----------|---------------------------|-------------|---------------------------------------|-------------------|-------------------|-------------------|
|                                      | Interface | Jitter Measurement Filter | Limit in UI | Equivalent limit in time domain       | Typ. <sup>†</sup> | Max. <sup>‡</sup> | Units             |
| <b>Option 1</b>                      |           |                           |             |                                       |                   |                   |                   |
| 1                                    | STM-16    | 1 MHz to 20 MHz           | 0.1 Ulpp    | 40.2                                  | -                 | 12.6              | ps <sub>P-P</sub> |
|                                      |           |                           | -           | -                                     | 1.0               | 1.5               | ps <sub>RMS</sub> |
|                                      |           | 5 kHz to 20 MHz           | 0.5 Ulpp    | 201                                   | -                 | 17.1              | ps <sub>P-P</sub> |
|                                      |           |                           | -           | -                                     | 1.3               | 2.2               | ps <sub>RMS</sub> |
| 2                                    | STM-4     | 250 kHz to 5 MHz          | 0.1 Ulpp    | 161                                   | -                 | 5.8               | ps <sub>P-P</sub> |
|                                      |           |                           | -           | -                                     | 0.46              | 0.9               | ps <sub>RMS</sub> |
|                                      |           | 1 kHz to 5 MHz            | 0.5 Ulpp    | 804                                   | -                 | 29.8              | ps <sub>P-P</sub> |
|                                      |           |                           | -           | -                                     | 2.4               | 3.2               | ps <sub>RMS</sub> |
| <b>Option 2</b>                      |           |                           |             |                                       |                   |                   |                   |
| 3                                    | STM-16    | 12 kHz - 20 MHz           | 0.1 Ulpp    | 40.2                                  | -                 | 16.9              | ps <sub>P-P</sub> |
|                                      |           |                           | -           | -                                     | 1.3               | 2.1               | ps <sub>RMS</sub> |
| 4                                    | STM-4     | 12 kHz - 5 MHz            | 0.1 Ulpp    | 161                                   | -                 | 9.0               | ps <sub>P-P</sub> |
|                                      |           |                           | -           | -                                     | 0.7               | 1.3               | ps <sub>RMS</sub> |

<sup>†</sup> Typical figures are for design aid only: not guaranteed and not subject to production testing.

<sup>‡</sup> Loop Filter components:  $R_F=8.2\text{ k}\Omega$ ,  $C_F=470\text{ nF}$



| Symbol       | Control Dimensions<br>in millimetres |      | Altern. Dimensions<br>in inches |       |
|--------------|--------------------------------------|------|---------------------------------|-------|
|              | MIN                                  | MAX  | MIN                             | MAX   |
| A            | ---                                  | 1.20 | ---                             | 0.047 |
| A1           | 0.05                                 | 0.15 | 0.002                           | 0.006 |
| A2           | 0.95                                 | 1.05 | 0.037                           | 0.041 |
| D            | 12.00 BSC                            |      | 0.472 BSC                       |       |
| D1           | 10.00 BSC                            |      | 0.394 BSC                       |       |
| E            | 12.00 BSC                            |      | 0.472 BSC                       |       |
| E1           | 10.00 BSC                            |      | 0.394 BSC                       |       |
| L            | 0.45                                 | 0.75 | 0.018                           | 0.030 |
| e            | 0.50 BSC                             |      | 0.020 BSC                       |       |
| b            | 0.17                                 | 0.27 | 0.007                           | 0.011 |
| c            | 0.09                                 | 0.20 | 0.004                           | 0.008 |
| Pin features |                                      |      |                                 |       |
| N            | 64                                   |      |                                 |       |
| ND           | 16                                   |      |                                 |       |
| NE           | 16                                   |      |                                 |       |
| NOTE         | SQUARE                               |      |                                 |       |

Conforms to JEDEC MS-026 ACD Iss. C

- Notes:
- Pin 1 indicator may be a corner chamfer, dot or both.
  - Controlling dimensions are in millimeters.
  - The top package body size may be smaller than the bottom package body size by a max. of 0.15 mm.
  - Dimension D1 and E1 do not include mould protrusion.
  - Dimension b does not include dambar protrusion.
  - Coplanarity, measured at seating plane G, to be 0.08 mm max.
  - Dashed area represents exposed paddle for e-PAD Packages only.
    - See leadframe drawing for e-Pad dimension.
    - Metal area of exposed die pad shall be within 0.30mm of nominal pad size.

|   |         |        |         |  |                        |  |
|---|---------|--------|---------|--|------------------------|--|
| © Zarlink Semiconductor 2002 All rights reserved. |         |        |         |  | Package Code           | QD/QG  |
| ISSUE   | 1       | 2      | 3       |  | Previous package codes | Package Outline for 64 Lead<br>TQFP / e-Pad TQFP<br>10x10x1.0mm, +2.0mm<br>(footprint) |
| ACN   | 203170  | 207075 | 213856  |  | TP/TH                  |  |
| DATE  | 14Oct97 | 5Jul99 | 17Dec02 |  |                        | GPD00450   |
| APPRD.  |         |        |         |  |                        |  |



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