



# **+3.3V, 622Mbps, SDH/SONET 1:8 Deserializer with TTL Outputs**

## **General Description**

The MAX3680/MAX3680A deserializer is ideal for converting 622Mbps serial data to 8-bit-wide, 77Mbps parallel data in ATM and SDH/SONET applications. Operating from a single +3.3V supply, this device accepts PECL serial clock and data inputs, and delivers TTL clock and data outputs. The MAX3680 also provides a TTL synchronization input that enables data realignment and reframing.

The MAX3680/MAX3680A is available in the extended-industrial temperature range (-40°C to +85°C), in a 28-pin SSOP package.

## **Applications**

622Mbps SDH/SONET Transmission Systems  
622Mbps ATM/SONET Access Nodes  
Add/Drop Multiplexers  
Digital Cross-Connects

*Pin Configuration appears at end of data sheet.*

## **Features**

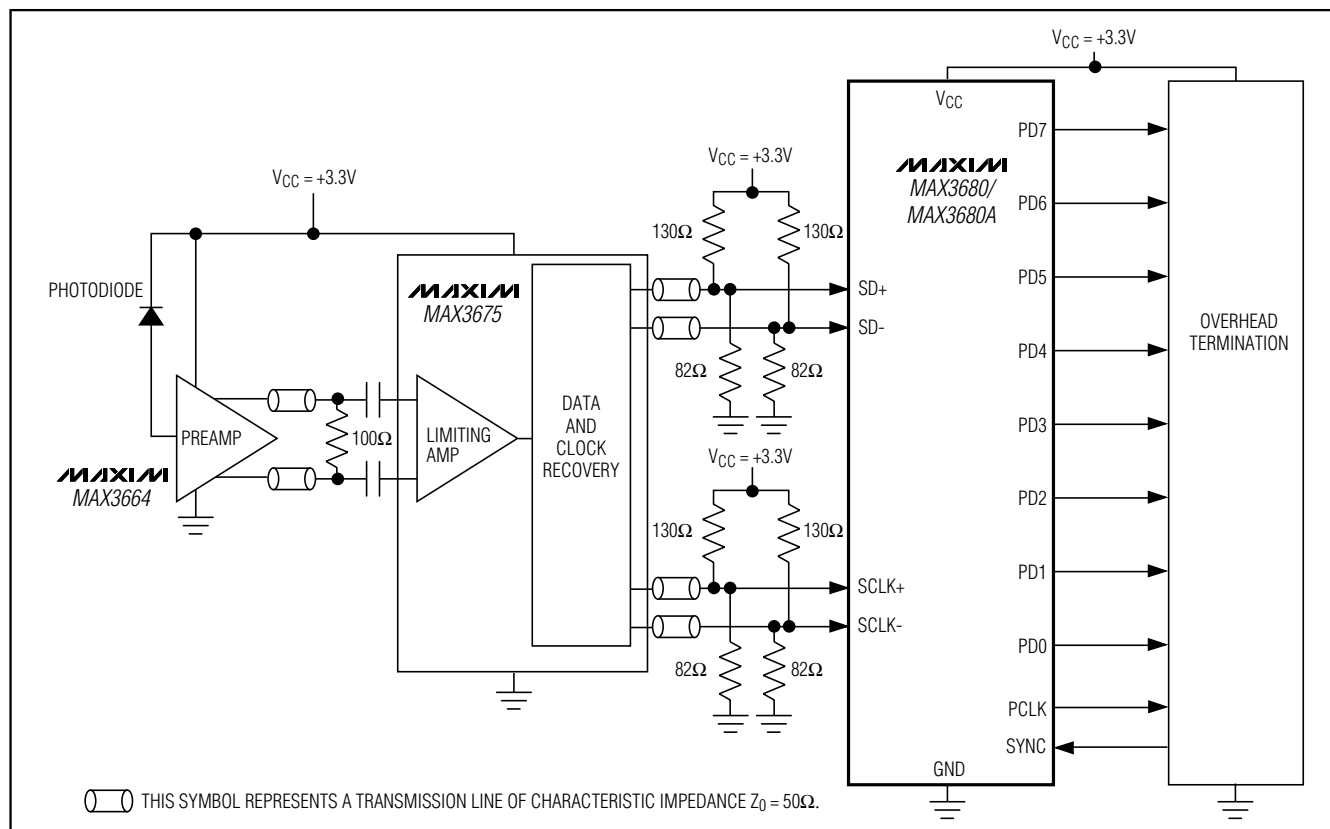
- ◆ **Single +3.3V Supply**
- ◆ **622Mbps Serial to 77Mbps Parallel Conversion**
- ◆ **165mW Power**
- ◆ **Synchronization Input for Data Realignment and Reframing (MAX3680)**
- ◆ **Differential 3.3V PECL Clock and Data Inputs**
- ◆ **TTL Data Outputs**

## **Ordering Information**

| PART        | TEMP RANGE     | PIN-PACKAGE |
|-------------|----------------|-------------|
| MAX3680EAI  | -40°C to +85°C | 28 SSOP     |
| MAX3680EAI+ | -40°C to +85°C | 28 SSOP     |
| MAX3680AEAI | -40°C to +85°C | 28 SSOP     |

+Denotes lead-free package.

## **Typical Operating Circuit**



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## ABSOLUTE MAXIMUM RATINGS

Terminal Voltage (with respect to GND)

|                                    |                                   |
|------------------------------------|-----------------------------------|
| V <sub>CC</sub> .....              | -0.5V to +5V                      |
| PECL Inputs (SD+/-, SCLK+/-) ..... | -0.5V to (V <sub>CC</sub> + 0.5V) |
| TTL Input (SYNC) .....             | -0.5V to (V <sub>CC</sub> + 0.5V) |
| TTL Outputs (PCLK, PD_) .....      | -0.5V to (V <sub>CC</sub> + 0.5V) |

Continuous Power Dissipation (T<sub>A</sub> = +85°C)

|                                           |                 |
|-------------------------------------------|-----------------|
| SSOP (derate 9.52mW/°C above +85°C) ..... | 619mW           |
| Operating Temperature Range .....         | -40°C to +85°C  |
| Storage Temperature Range .....           | -65°C to +160°C |
| Lead Temperature (soldering, 10s) .....   | +300°C          |

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## DC ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = +3.0V to +3.6V, T<sub>A</sub> = -40°C to +85°C, unless otherwise noted. Typical values are at V<sub>CC</sub> = +3.3V, T<sub>A</sub> = +25°C.)

| PARAMETER                                               | SYMBOL          | CONDITIONS                              | MIN                    | TYP | MAX                    | UNITS |
|---------------------------------------------------------|-----------------|-----------------------------------------|------------------------|-----|------------------------|-------|
| Supply Current                                          | I <sub>CC</sub> | TTL outputs = high                      | 25                     | 50  | 90                     | mA    |
| <b>PECL INPUTS (SD+/-, SCLK+/-)</b>                     |                 |                                         |                        |     |                        |       |
| Input High Voltage                                      | V <sub>IH</sub> |                                         | V <sub>CC</sub> - 1.16 |     | V <sub>CC</sub> - 0.88 | V     |
| Input Low Voltage                                       | V <sub>IL</sub> |                                         | V <sub>CC</sub> - 1.81 |     | V <sub>CC</sub> - 1.48 | V     |
| Input High Current                                      | I <sub>IH</sub> | V <sub>IN</sub> = V <sub>IH</sub> (MAX) | -10                    |     | 10                     | μA    |
| Input Low Current                                       | I <sub>IL</sub> | V <sub>IN</sub> = V <sub>IL</sub> (MAX) | -10                    |     | 10                     | μA    |
| <b>TTL INPUT AND OUTPUTS (SYNC, PCLK, PD_) (Note 1)</b> |                 |                                         |                        |     |                        |       |
| Input High Voltage                                      | V <sub>IH</sub> |                                         | 2.0                    |     |                        | V     |
| Input Low Voltage                                       | V <sub>IL</sub> |                                         |                        |     | 0.8                    | V     |
| Input High Current                                      | I <sub>IH</sub> | V <sub>IN</sub> = V <sub>IH</sub> (MAX) | -10                    |     | 10                     | μA    |
| Input Low Current                                       | I <sub>IL</sub> | V <sub>IN</sub> = V <sub>IL</sub> (MAX) | -10                    |     | 10                     | μA    |
| Output High Voltage                                     | V <sub>OH</sub> | Output sourcing = 400μA                 | 2.4                    |     | V <sub>CC</sub>        | V     |
| Output Low Voltage                                      | V <sub>OL</sub> | Output sinking = 400μA                  | 0                      |     | 0.44                   | V     |

**Note 1:** The SYNC input is available only on the MAX3680.

## AC ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = +3.0V to +3.6V, T<sub>A</sub> = +25°C, unless otherwise noted.) (Note 2)

| PARAMETER                           | SYMBOL             | CONDITIONS                                     | MIN  | TYP | MAX  | UNITS |
|-------------------------------------|--------------------|------------------------------------------------|------|-----|------|-------|
| Maximum Serial Clock Frequency      | f <sub>SCLK</sub>  |                                                | 622  |     |      | MHz   |
| Serial Data Setup Time              | t <sub>SU</sub>    |                                                | 800  |     |      | ps    |
| Serial Data Hold Time               | t <sub>H</sub>     |                                                | 50   |     |      | ps    |
| Parallel Clock to Data Output Delay | t <sub>CLK-Q</sub> | V <sub>CC</sub> = +3.3V, C <sub>L</sub> = 18pF | -200 | 500 | 2000 | ps    |

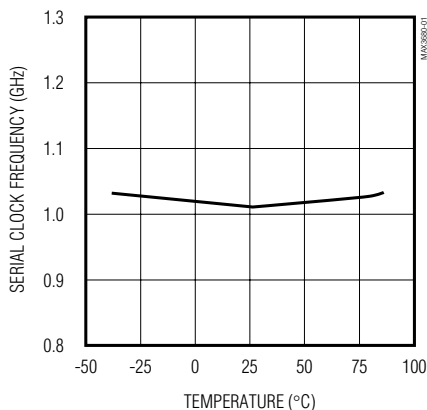
**Note 2:** AC characteristics guaranteed by design and characterization.

# **+3.3V, 622Mbps, SDH/SONET 1:8 Deserializer with TTL Outputs**

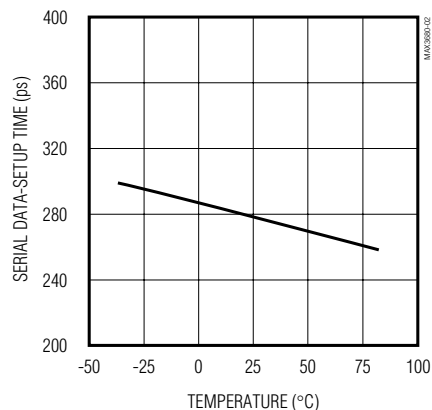
## **Typical Operating Characteristics**

( $V_{CC}$  = +3.0V to +3.6V, unless otherwise noted.)

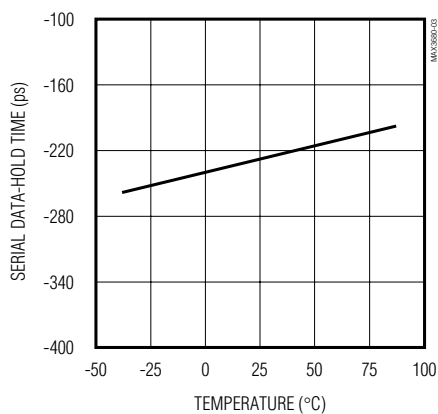
**MAXIMUM SERIAL-CLOCK FREQUENCY  
vs. TEMPERATURE**



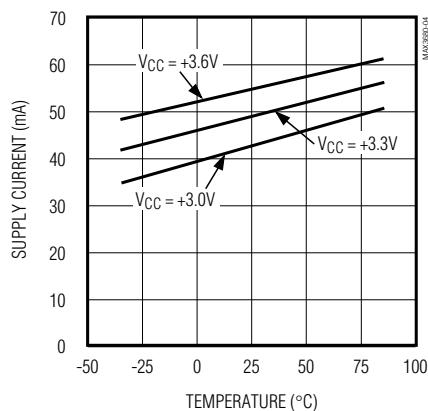
**SERIAL DATA SETUP TIME  
vs. TEMPERATURE**



**SERIAL DATA HOLD TIME  
vs. TEMPERATURE**



**SUPPLY CURRENT  
vs. TEMPERATURE**



**MAX3680/MAX3680A**

# +3.3V, 622Mbps, SDH/SONET 1:8 Deserializer with TTL Outputs

## Pin Description

| PIN                                  |                                      | NAME    | FUNCTION                                                                                                                                                                   |
|--------------------------------------|--------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MAX3680                              | MAX3680A                             |         |                                                                                                                                                                            |
| 1, 2, 5, 8,<br>14, 18, 25            | 1, 2, 5, 8,<br>14, 18, 25            | VCC     | +3.3V Supply Voltage                                                                                                                                                       |
| 3                                    | 3                                    | SD+     | Noninverting PECL Serial Data Input. Data is clocked on the SCLK signal's positive transition.                                                                             |
| 4                                    | 4                                    | SD-     | Inverting PECL Serial Data Input. Data is clocked on the SCLK signal's positive transition.                                                                                |
| 6                                    | 6                                    | SCLK+   | Noninverting PECL Serial Clock Input                                                                                                                                       |
| 7                                    | 7                                    | SCLK-   | Inverting PECL Serial Clock Input                                                                                                                                          |
| 9, 11, 12,<br>16, 20, 23,<br>27      | 11, 12, 16,<br>20, 23, 27            | GND     | Ground                                                                                                                                                                     |
| 10                                   | —                                    | SYNC    | TTL Synchronization Pulse Input. Pulse high for at least two SCLK periods to shift the data alignment by dropping one bit in the serial input data stream.                 |
| —                                    | 9, 10                                | N.C.    | No Connection                                                                                                                                                              |
| 13                                   | 13                                   | PCLK    | TTL Parallel Clock Output                                                                                                                                                  |
| 15, 17, 19,<br>21, 22, 24,<br>26, 28 | 15, 17, 19,<br>21, 22, 24,<br>26, 28 | PD0-PD7 | TTL Parallel Data Outputs. Data is updated on the falling edge of PCLK. See Figure 2 for the relationship between serial-data-bit position and output-data-bit assignment. |

## Detailed Description

The MAX3680/MAX3680A deserializer uses an 8-bit shift register, 8-bit parallel output register, 3-bit counter, PECL input buffers, and TTL input/output buffers to convert 622Mbps serial data to 8-bit-wide, 77Mbps parallel data (Figure 1).

The input shift register continuously clocks incoming data on the positive transition of the serial clock (SCLK) input signal. The 3-bit counter generates a parallel output clock (PCLK) by dividing down the serial clock frequency. The PCLK signal is used to clock the parallel output register. During normal operation, the counter divides the SCLK frequency by eight, causing the output register to latch every eight bits of incoming serial data.

The MAX3680 synchronization input (SYNC) is used for data realignment and reframing. When the SYNC signal is pulsed high for at least two SCLK cycles, PCLK is delayed by one SCLK cycle, causing the first incoming bit of the serial input data stream to be dropped. This realignment is guaranteed to occur within two PCLK cycles of the SYNC rising edge.

See Figure 2 for the functional timing diagrams and Figure 3 for the timing parameters diagram.

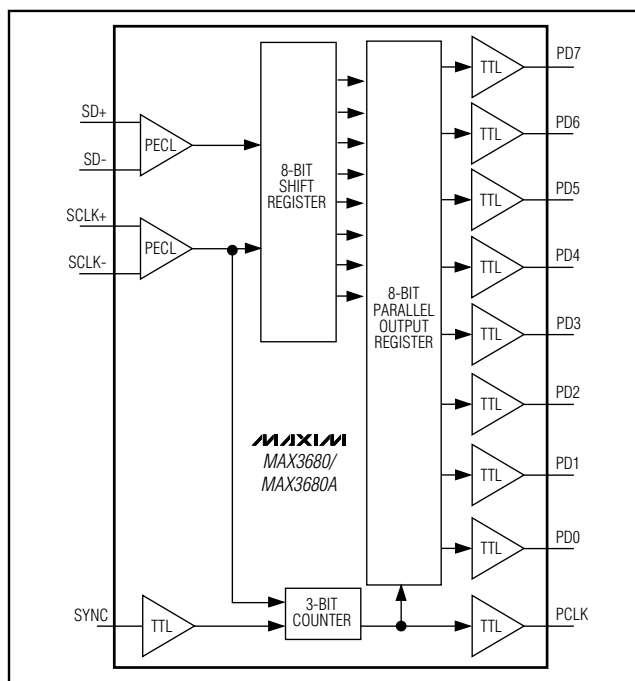
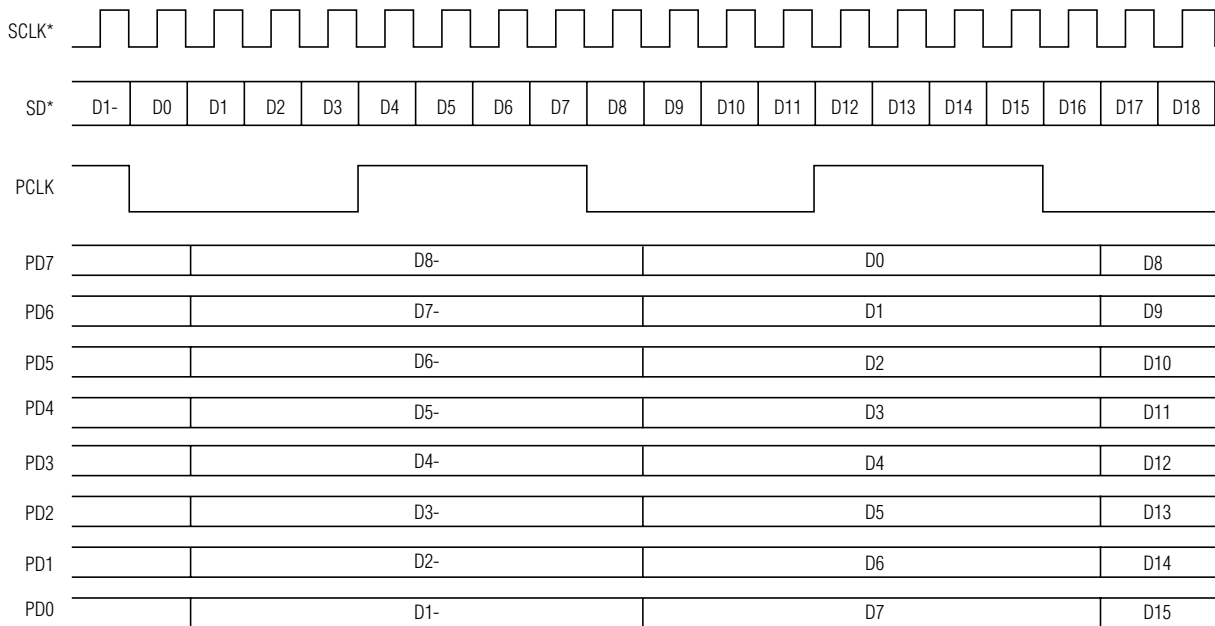


Figure 1. Functional Diagram

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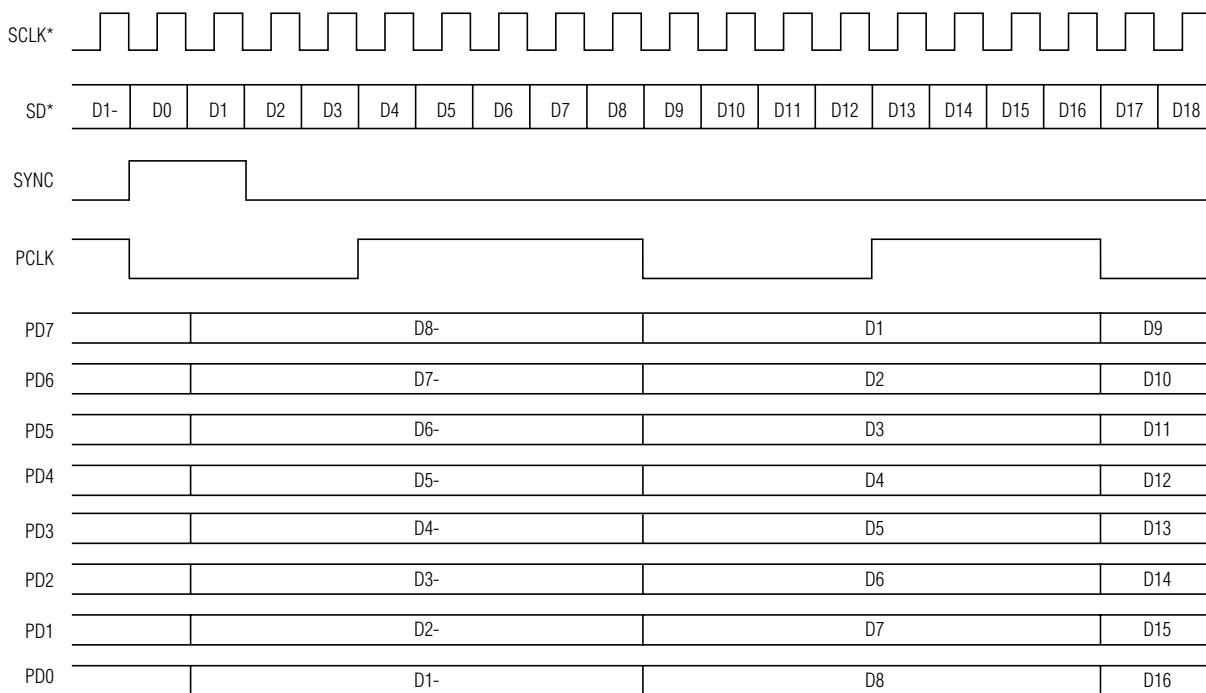
**MAX3680/MAX3680A**



\* SIGNAL SHOWN IS DIFFERENTIAL. FOR EXAMPLE, SCLK = (SCLK+) - (SCLK-).

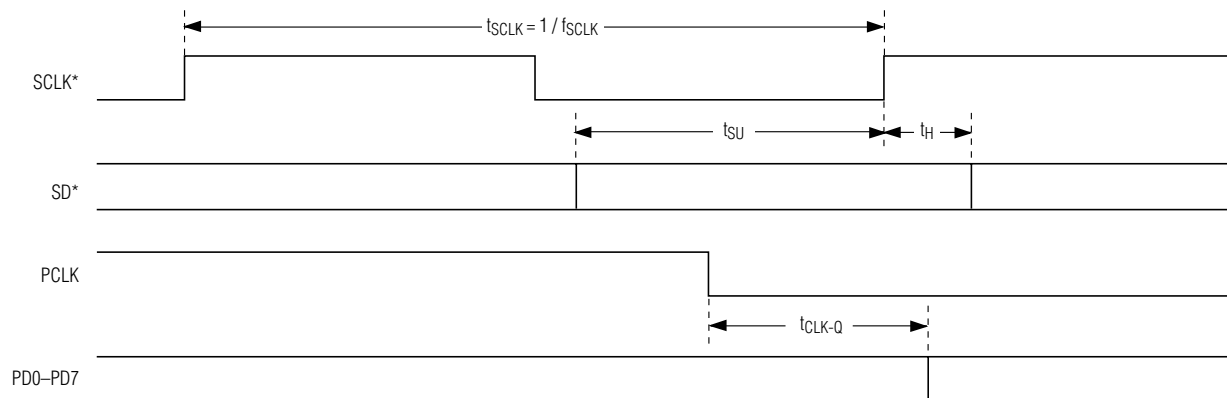
Figure 2a. Functional Timing Diagram—Normal Operation

# +3.3V, 622Mbps, SDH/SONET 1:8 Deserializer with TTL Outputs



\* SIGNAL SHOWN IS DIFFERENTIAL. FOR EXAMPLE, SCLK = (SCLK+) - (SCLK-).

Figure 2b. Functional Timing Diagram—SYNC Operation (MAX3680)



\* SIGNAL SHOWN IS DIFFERENTIAL. FOR EXAMPLE, SCLK = (SCLK+) - (SCLK-).

Figure 3. Timing Parameters

# +3.3V, 622Mbps, SDH/SONET 1:8 Deserializer with TTL Outputs

MAX3680/MAX3680A

## PECL Inputs

The serial data and clock PECL inputs (SD+, SD-, SCLK+, SCLK-) require  $50\Omega$  termination to ( $V_{CC} - 2V$ ) when interfacing with a PECL source (see *Alternative PECL Input Termination*).

## Applications Information

### Alternative PECL Input Termination

Figure 4 shows alternative PECL input-termination methods. Use Thevenin-equivalent termination when a ( $V_{CC} - 2V$ ) termination voltage is not available. If AC coupling is necessary, such as when interfacing with an ECL-output device, use the ECL AC-coupling termination.

### Layout Techniques

For best performance, use good high-frequency layout techniques. Filter voltage supplies and keep ground connections short. Use multiple vias where possible. Also, use controlled impedance transmission lines to interface with the MAX3680 data inputs.

## Pin Configuration

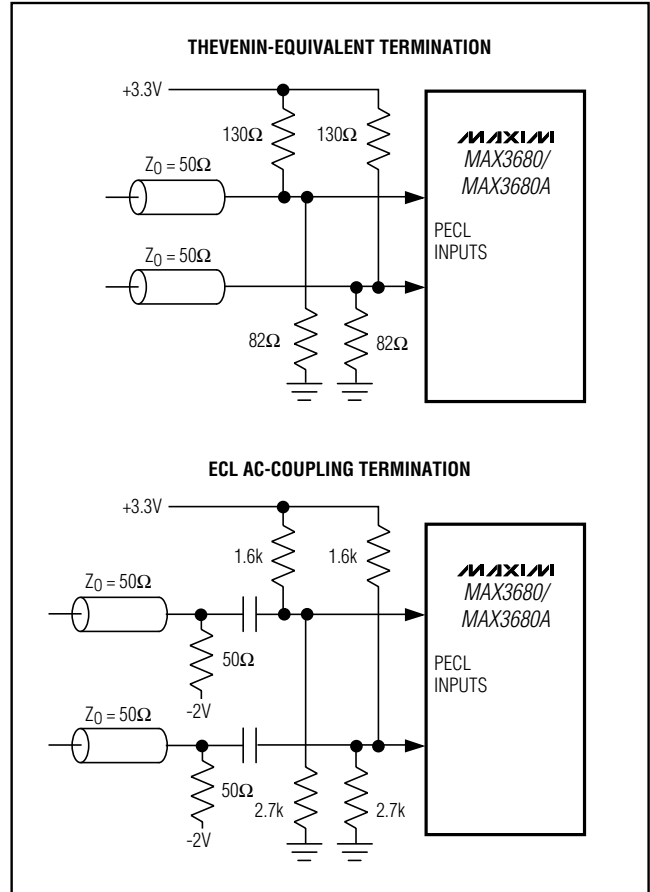
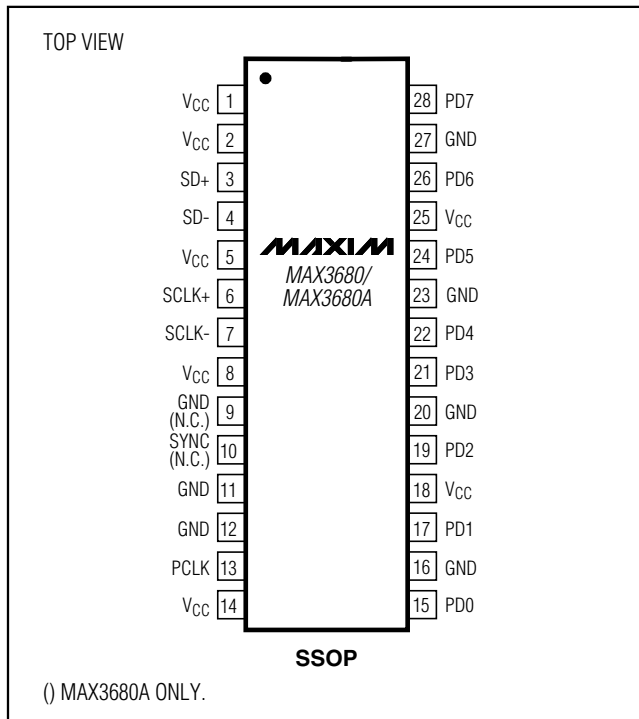


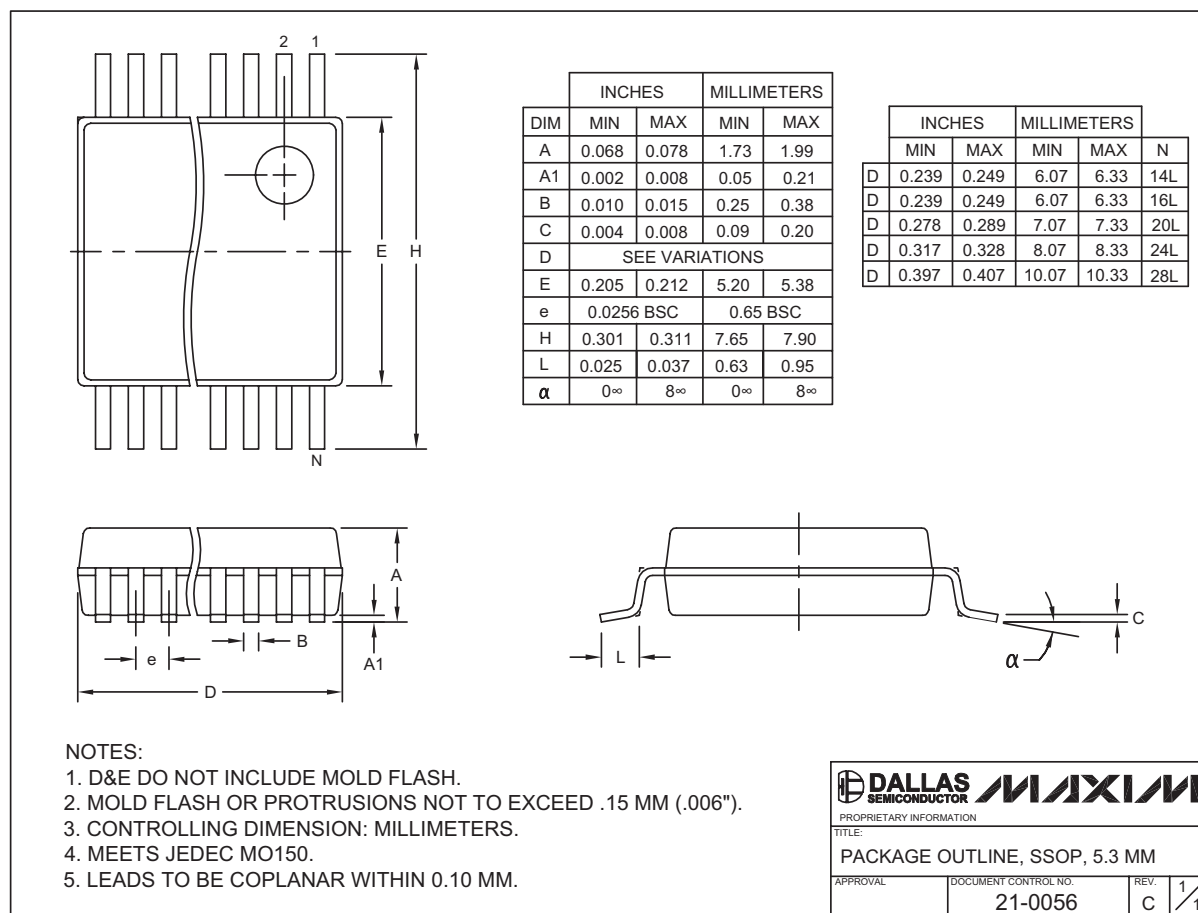
Figure 4. Alternative PECL Input Termination

## Chip Information

TRANSISTOR COUNT: 1346

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## Package Information



## Revision History

- Rev 0; 3/97: Initial MAX3680 release.
- Rev 1; 11/00: Changed t<sub>CLK-Q</sub> max from 1300ps to 2000ps (page 2); replaced TOC3 (page 3).
- Rev 2; 7/04: Added lead-free package to Ordering Information table (page 1).
- Rev 3; 3/07: Added MAX3680A (pages 1, 2, 4, 6, 7).

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