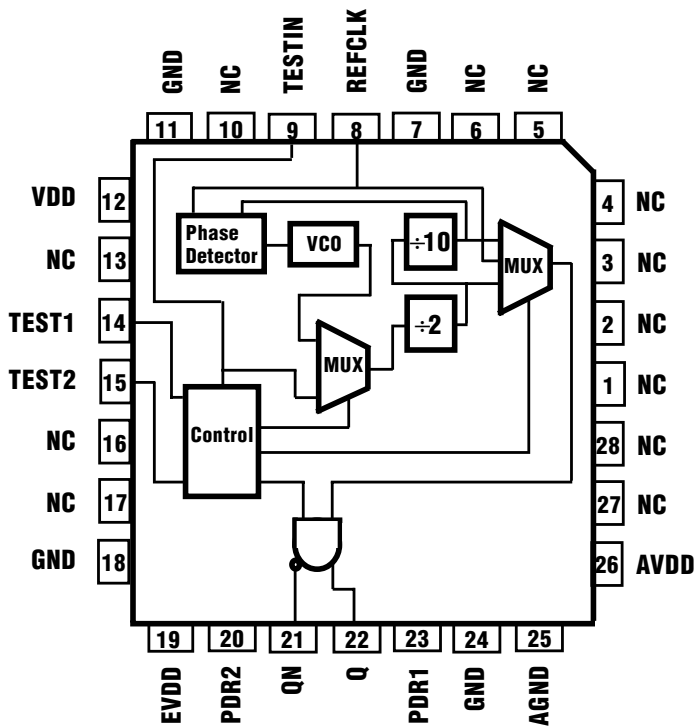


Figure 1. Pinout Diagram



TriQuint's TQ2060 is a high-frequency clock generator. It utilizes a 35 MHz to 50 MHz TTL input to generate a 350 MHz to 500 MHz PECL output. The TQ2060 has a completely self-contained Phase-Locked Loop (PLL) running at 700 MHz to 1000 MHz. This stable PLL allows for a low period-to-period output jitter of 70 ps (max), and enables tight duty cycle control of 55% to 45% (worst case).

The TQ2060 provides optional 200 ohm on-chip pull-down resistors which are useful if the output is AC-coupled to the device being driven. In order to use these resistors, pin 20 (PDR2) should be connected to pin 21 (QN), and pin 23 (PDR1) should be connected to pin 22 (Q).

Various test modes on the chip simplify debug and testing of systems by slowing the clock output or by bypassing the PLL.

## TQ2060

### High-Frequency Clock Generator

#### Features

- Output frequency range: 350 MHz to 500 MHz
- One differential PECL output: 600 mV (min) swing
- Common-mode voltage:  $V_{DD} - 1.2$  V (max),  $V_{DD} - 1.6$  V (min)
- Period-to-period output jitter: 25 ps peak-to-peak (typ) 70 ps peak-to-peak (max)
- Reference clock input: 35 MHz to 50 MHz TTL-level crystal oscillator
- Self-contained loop filter
- Optional 200-ohm pull-down resistors for AC-coupled outputs
- +5 V power supply
- 28-pin J-lead surface-mount package
- Ideal for designs based on DEC Alpha AXP™ processors

## TQ2060

Figure 2. Simplified Block Diagram

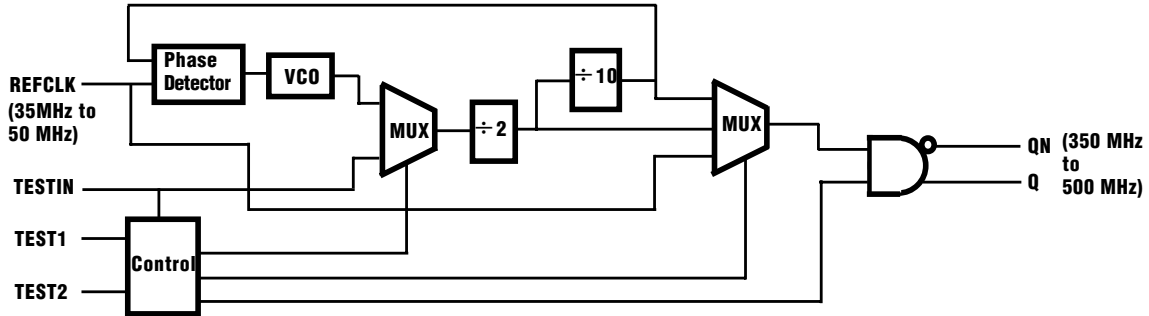
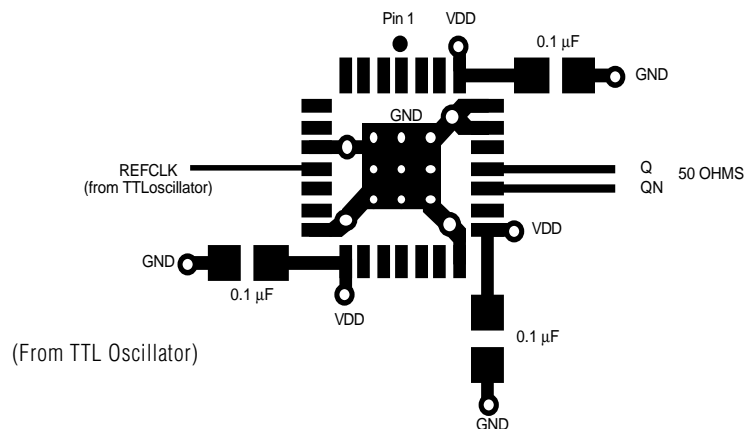


Table 1. Mode Selection

| Mode       | TEST1 | TEST2 | TESTIN <sup>1</sup> | REFCLK       | Q, QN                    |
|------------|-------|-------|---------------------|--------------|--------------------------|
| 1 (Test)   | 0     | 0     | $f_{TESTCLK}$       | "don't care" | $f_{REFCLK}^2 \div 20$   |
| 2 (Test)   | 0     | 1     | "don't care"        | "don't care" | 0, 1                     |
| 3 (Test)   | 1     | 0     | $f_{TESTCLK}$       | "don't care" | $f_{TESTCLK} \div 2$     |
| 4 (Bypass) | 1     | 1     | 0                   | $f_{REFCLK}$ | $f_{REFCLK}$             |
| 5 (Normal) | 1     | 1     | 1                   | $f_{REFCLK}$ | $10 \times f_{REFCLK}^3$ |

Notes: 1. In modes 1 and 3, TESTIN may be used to bypass the PLL. A clock input at TESTIN will be divided as shown.  
 2. REFCLK = 35 MHz to 50 MHz.  
 3. Q, QN = 350 MHz to 500 MHz.

Figure 3. Recommended Layout  
(Not to scale)



**Table 2. Absolute Maximum Ratings**

|  |                                     |
|--|-------------------------------------|
| Storage Temperature                    | -65°C to +150°C                     |
| Ambient temperature with power applied | -55°C to +110°C                     |
| Supply voltage to ground potential     | -0.5 V to +7.0 V                    |
| DC input voltage                       | -0.5 V to (V <sub>DD</sub> + 0.5) V |
| DC input current                       | -30 mA to +5 mA                     |
| Package thermal resistance (MQuad)     | θ <sub>JA</sub> = 45°C/W            |
| Die junction temperature               | T <sub>J</sub> = 150°C              |

Note: Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device.  
The device should be operated only under the DC and AC conditions shown below.

**Table 3. DC Characteristics (V<sub>DD</sub> = +5 V ± 5%, T<sub>A</sub> = 0 °C to +70 °C) <sup>1</sup>**

| Symbol                       | Description                 | Test Conditions   | Min                   | Typ   | Max                   | Unit |
|------------------------------|-----------------------------|---|-----------------------|-------|-----------------------|------|
| V <sub>OH</sub>              | Output HIGH voltage         | V <sub>CC</sub> = Min PECL load                         | V <sub>CC</sub> -1.20 |       | V <sub>CC</sub> -0.50 | V    |
| V <sub>OL</sub>              | Output LOW voltage          | V <sub>CC</sub> = Min PECL load                         | V <sub>CC</sub> -2.00 |       | V <sub>CC</sub> -1.60 | V    |
| V <sub>CMO</sub>             | Output common mode voltage  | PECL  | V <sub>CC</sub> -1.60 |       | V <sub>CC</sub> -1.20 | V    |
| Δ V <sub>OUT</sub>           | Output differential voltage | PECL  | 0.6                   |       | 1.2                   | V    |
| V <sub>IH</sub> <sup>2</sup> | Input HIGH level            | Guaranteed input logical<br>HIGH Voltage for all inputs | 2.0                   |       |                       | V    |
| V <sub>IL</sub> <sup>2</sup> | Input LOW level             | Guaranteed input logical<br>LOW Voltage for all inputs  |                       |       | 0.8                   | V    |
| I <sub>IL</sub>              | Input LOW current           | V <sub>DD</sub> = Max V <sub>IN</sub> = 0.40 V          |                       | -150  | -400                  | μA   |
| I <sub>IH</sub>              | Input HIGH current          | V <sub>DD</sub> = Max V <sub>IN</sub> = 2.7 V           |                       | 0     | 25                    | μA   |
| I <sub>I</sub>               | Input HIGH current          | V <sub>DD</sub> = Max V <sub>IN</sub> = 5.3 V           |                       | 2     | 1000                  | μA   |
| I <sub>DD</sub> <sup>3</sup> | Power supply current        | V <sub>DD</sub> = Max                                   |                       | 85    | 120                   | mA   |
| V <sub>I</sub>               | Input clamp voltage         | V <sub>DD</sub> = Min I <sub>IN</sub> = -18 mA          |                       | -0.70 | -1.2                  | V    |

**Table 4. Capacitance**

| Symbol           | Description        | Test Conditions                       | Min | Typ | Max | Unit |
|------------------|--------------------|---------------------------------------|-----|-----|-----|------|
| C <sub>IN</sub>  | Input Capacitance  | V <sub>IN</sub> = 2.0 V at f = 1 MHz  |     | 6   |     | pF   |
| C <sub>OUT</sub> | Output Capacitance | V <sub>OUT</sub> = 2.0 V at f = 1 MHz |     | 9   |     | pF   |

Notes: 1. Typical limits are at V<sub>DD</sub> = 5.0 V and T<sub>A</sub> = 25°C.

2. These are absolute values with respect to device ground and include all overshoots due to system or tester noise.

3. This parameter is measured with device not switching and unloaded.

## TQ2060

**Table 5. AC Characteristics** ( $V_{DD} = +5\text{ V} \pm 5\%$ ,  $T_A = 0^\circ\text{C to } +70^\circ\text{C}$ )

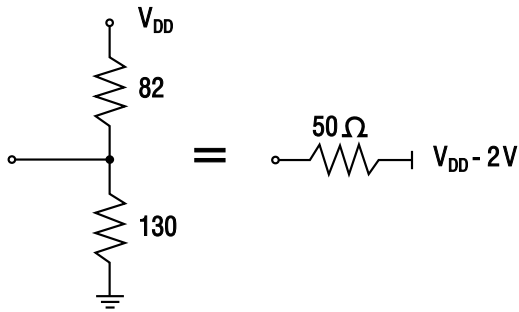
| Symbol     | Input Clock (REFCLK)            | Test Conditions (Figure 5) | Min | Typ | Max | Unit |
|------------|---------------------------------|----------------------------|-----|-----|-----|------|
| $t_{CPWH}$ | CLK pulse width HIGH            | Figure 5                   | 4   | —   | —   | ns   |
| $t_{CPWL}$ | CLK pulse width LOW             | Figure 5                   | 4   | —   | —   | ns   |
| $t_{IR}$   | Input rise time (0.8 V – 2.0 V) |                            | —   | —   | 2.0 | ns   |

| Symbol           | Output Clock (Q, QN)       | Test Conditions (Figures 4 & 5) <sup>1</sup> | Min | Typ | Max | Unit          |
|------------------|----------------------------|--|-----|-----|-----|---------------|
| $t_{OR}, t_{OF}$ | Rise/fall time (20% – 80%) | Figure 5                                     | 100 | 220 | 350 | ps            |
| $t_{CYC}$        | Duty-cycle                 | Figure 5                                     | 45  | 50  | 55  | %             |
| $t_{JP}^2$       | Period-to-Period Jitter    |  | —   | 25  | 70  | ps            |
| $t_{SYNC}^3$     | Synchronization Time       |  | —   | 10  | 500 | $\mu\text{s}$ |

Notes: 1. All measurements are tested with a REFCLK having a rise time of 0.5 ns (0.8 V to 2.0 V).  
 2. Jitter specification is peak to peak. Period-to-Period jitter is the jitter on the output with respect to the output's previous crossing.  
 3.  $t_{SYNC}$  is the time required for the PLL to synchronize and assumes the presence of a CLK signal.

**Figure 4. PECL Test Load**



**Figure 5. REFCLK and Q-QN Timing**

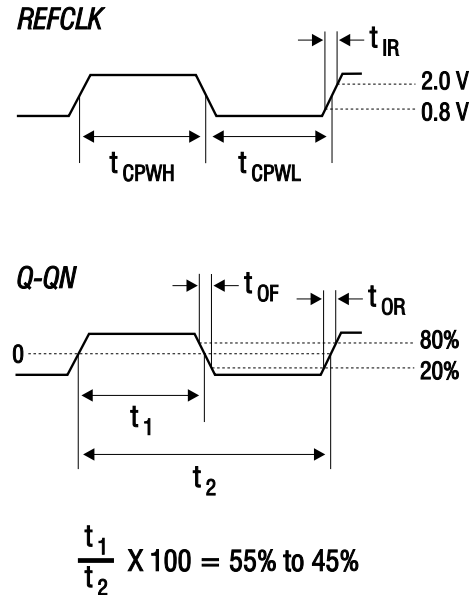


Figure 6. 28-Pin MQuad J-Leaded Package Mechanical Specification

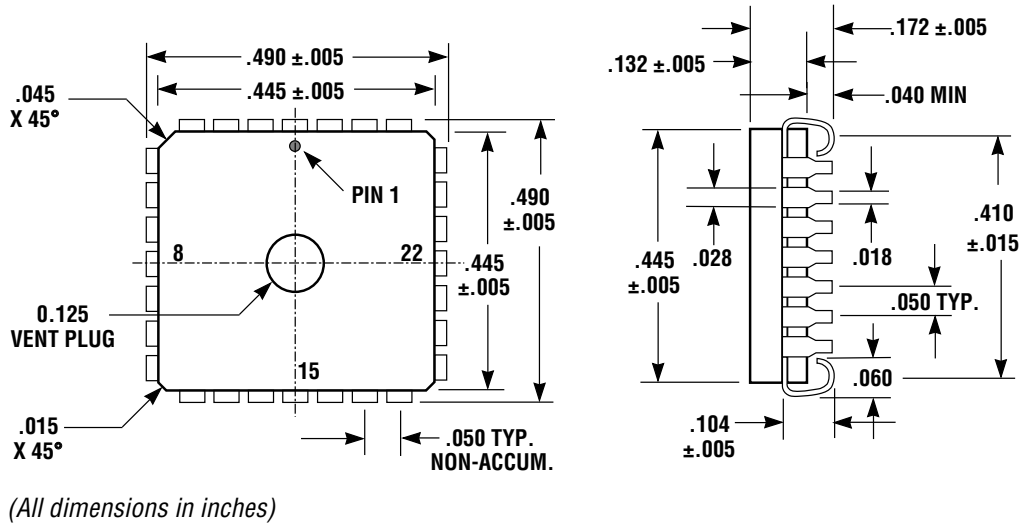


Table 6. 28-Pin MQuad Pin Description

| Pin # | Pin Name | Description      | I/O | Pin # | Pin Name | Description                  | I/O |
|-------|----------|------------------|-----|-------|----------|------------------------------|-----|
| 1     | NC       | No Connect       | —   | 15    | TEST2    | Test Control 2               | I   |
| 2     | NC       | No Connect       | —   | 16    | NC       | No Connect                   | —   |
| 3     | NC       | No Connect       | —   | 17    | NC       | No Connect                   | O   |
| 4     | NC       | No Connect       | —   | 18    | GND      | Ground                       | —   |
| 5     | NC       | No Connect       | —   | 19    | EVDD     | VDD for ECL Output (+5 V)    | —   |
| 6     | NC       | No Connect       | —   | 20    | PDR2     | Pull-down Resistor 2 (200 Ω) | I   |
| 7     | GND      | Ground           | —   | 21    | QN       | Differential PECL Output (-) | O   |
| 8     | REFCLK   | Reference Clock  | I   | 22    | Q        | Differential PECL Output (+) | O   |
| 9     | TESTIN   | Test Input       | I   | 23    | PDR1     | Pull-down Resistor 1 (200 Ω) | I   |
| 10    | NC       | No Connect       | —   | 24    | GND      | Ground                       | —   |
| 11    | GND      | Logic Ground     | —   | 25    | AGND     | Analog Ground                | —   |
| 12    | VDD      | Logic VDD (+5 V) | —   | 26    | AVDD     | Analog VDD (+5 V)            | —   |
| 13    | NC       | No Connect       | —   | 27    | NC       | No Connect                   | —   |
| 14    | TEST1    | Test Control 1   | I   | 28    | NC       | No Connect                   | —   |

SYSTEM TIMING PRODUCTS

## TQ2060

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### **Ordering Information**

To order, please specify as shown below:

**TQ2060-MC**      *High-Frequency Clock Generator*

Temperature range: 0°C to 70°C (Commercial)

Package: 28-Pin MQuad

### **Additional Information**

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Revision 1.0.A      October 1997