



2.5V or 3.3V, 125-MHz, 14 Output Zero Delay Buffer

Features

- Output frequency range: 8.3 MHz to 125 MHz
- Input frequency range: 4.2 MHz to 62.5 MHz
- 2.5V or 3.3V operation
- Split 2.5V/3.3V outputs
- 14 Clock outputs: Drive up to 28 clock lines
- 1 Feedback clock output
- 2 LVCMOS reference clock inputs
- 150 ps max output-output skew
- PLL bypass mode
- Spread Aware™
- Output enable/disable
- Pin compatible with MPC9774
- Industrial temperature range: -40°C to +85°C
- 52-Pin 1.0-mm TQFP package

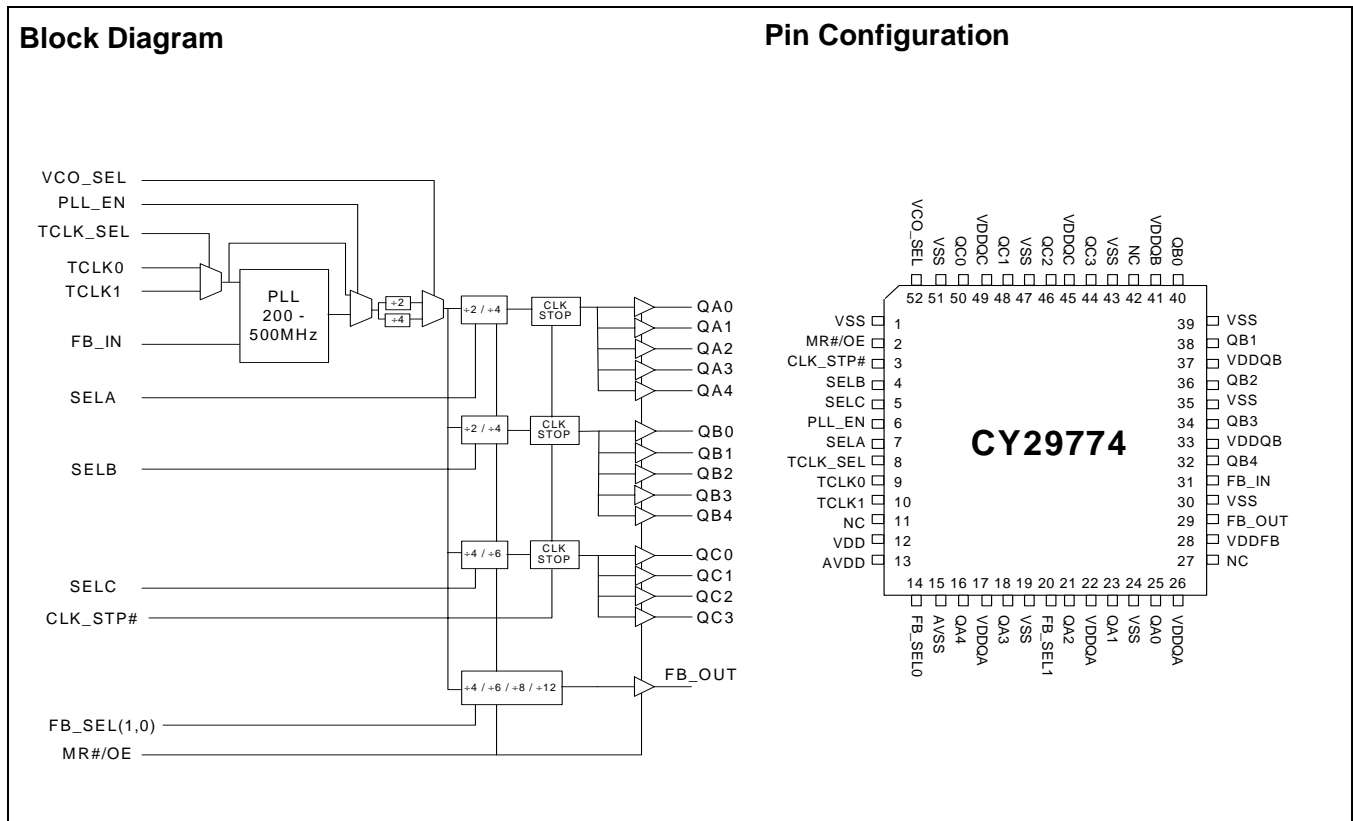
The CY29774 features two reference clock inputs and provides 14 outputs partitioned in 3 banks of 5, 5, and 4 outputs. Bank A and Bank B divide the VCO output by 4 or 8 while Bank C divides by 8 or 12 per SEL(A:C) settings, see *Functional Table*. These dividers allow output to input ratios of 6:1, 4:1, 3:1, 2:1, 3:2, 4:3, 1:1, and 2:3. Each LVCMOS compatible output can drive 50Ω series or parallel terminated transmission lines. For series terminated transmission lines, each output can drive one or two traces giving the device an effective fanout of 1:28.

The PLL is ensured stable given that the VCO is configured to run between 200 MHz to 500 MHz. This allows a wide range of output frequencies from 8.3 MHz to 125 MHz. For normal operation, the external feedback input, FB_IN, is connected to the feedback output, FB_OUT. The internal VCO is running at multiples of the input reference clock set by the feedback divider, see *Frequency Table*.

When PLL_EN is LOW, PLL is bypassed and the reference clock directly feeds the output dividers. This mode is fully static and the minimum input clock frequency specification does not apply.

Description

The CY29774 is a low-voltage high-performance 125-MHz PLL-based zero delay buffer designed for high-speed clock distribution applications.



Pin Description^[1]

| Pin | Name | I/O | Type | Description |
|---|-------------|--------|---------|---|
| 9 | TCLK0 | I, PD | LVC MOS | LVC MOS/LVTTL reference clock input |
| 10 | TCLK1 | I, PU | LVC MOS | LVC MOS/LVTTL reference clock input |
| 16, 18, 21, 23, 25 | QA(4:0) | O | LVC MOS | Clock output bank A |
| 32, 34, 36, 38, 40 | QB(4:0) | O | LVC MOS | Clock output bank B |
| 44, 46, 48, 50 | QC(3:0) | O | LVC MOS | Clock output bank C |
| 29 | FB_OUT | O | LVC MOS | Feedback clock output. Connect to FB_IN for normal operation. |
| 31 | FB_IN | I, PU | LVC MOS | Feedback clock input. Connect to FB_OUT for normal operation. This input should be at the same voltage rail as input reference clock. See <i>Table 1</i> . |
| 2 | MR#/OE | I, PU | LVC MOS | Output enable/disable input. See <i>Table 2</i> . |
| 3 | CLK_STP# | I, PU | LVC MOS | Clock stop enable/disable input. See <i>Table 2</i> . |
| 6 | PLL_EN | I, PU | LVC MOS | PLL enable/disable input. See <i>Table 2</i> . |
| 8 | TCLK_SEL | I, PD | LVC MOS | Reference select input. See <i>Table 2</i> . |
| 52 | VCO_SEL | I, PD | LVC MOS | VCO divider select input. See <i>Table 2</i> . |
| 7, 4, 5 | SEL(A:C) | I, PD | LVC MOS | Frequency select input, Bank (A:C). See <i>Table 3</i> . |
| 20, 14 | FB_SEL(1,0) | I, PD | LVC MOS | Feedback dividers select input. See <i>Table 4</i> . |
| 17, 22, 26 | VDDQA | Supply | VDD | 2.5V or 3.3V Power supply for bank A output clocks ^[2,3] |
| 33, 37, 41 | VDDQB | Supply | VDD | 2.5V or 3.3V Power supply for bank B output clocks ^[2,3] |
| 45, 49 | VDDQC | Supply | VDD | 2.5V or 3.3V Power supply for bank C output clocks ^[2,3] |
| 28 | VDDFB | Supply | VDD | 2.5V or 3.3V Power supply for feedback output clock ^[2,3] |
| 13 | AVDD | Supply | VDD | 2.5V or 3.3V Power supply for PLL ^[2,3] |
| 12 | VDD | Supply | VDD | 2.5V or 3.3V Power supply for core and inputs ^[2,3] |
| 15 | AVSS | Supply | Ground | Analog Ground |
| 1, 19, 24, 30, 35, 39, 43, 47, 51 | VSS | Supply | Ground | Common Ground |
| 11, 27, 42 | NC | | | No Connection |

Notes:

1. PU = Internal pull up, PD = Internal pull down
2. A 0.1- μ F bypass capacitor should be placed as close as possible to each positive power pin (<0.2"). If these bypass capacitors are not close to the pins their high frequency filtering characteristics will be cancelled by the lead inductance of the traces.
3. AVDD and VDD pins must be connected to a power supply level that is at least equal or higher than that of VDDQA, VDDQB, VDDQC, and VDDFB power supply pins.

Table 1. Frequency Table

| Feedback Output Divider | VCO | Input Frequency Range (AVDD = 3.3V) | Input Frequency Range (AVDD = 2.5V) |
|-------------------------|------------------|-------------------------------------|-------------------------------------|
| ÷8 | Input Clock * 8 | 25 MHz to 62.5 MHz | 25 MHz to 50 MHz |
| ÷12 | Input Clock * 12 | 16.6 MHz to 41.6 MHz | 16.6 MHz to 33.3 MHz |
| ÷16 | Input Clock * 16 | 12.5 MHz to 31.25 MHz | 12.5 MHz to 25 MHz |
| ÷24 | Input Clock * 24 | 8.3 MHz to 20.8 MHz | 8.3 MHz to 16.6 MHz |
| ÷32 | Input Clock * 32 | 6.25 MHz to 15.625 MHz | 6.25 MHz to 12.5 MHz |
| ÷48 | Input Clock * 48 | 4.2 MHz to 10.4 MHz | 4.2 MHz to 8.3 MHz |

Table 2. Function Table (configuration controls)

| Control | Default | 0 | 1 |
|----------|---------|---|---|
| TCLK_SEL | 0 | TCLK0 | TCLK1 |
| VCO_SEL | 0 | VCO÷2 (high input frequency range) | VCO÷4 (low input frequency range) |
| PLL_EN | 1 | Bypass mode, PLL disabled. The input clock connects to the output dividers | PLL enabled. The VCO output connects to the output dividers |
| MR#/OE | 1 | Outputs disabled (three-state) and reset of the device. During reset/output disable the PLL feedback loop is open and the VCO running at its minimum frequency. The device is reset by the internal power-on reset (POR) circuitry during power-up. | Outputs enabled |
| CLK_STP# | 1 | QA, QB, and QC outputs disabled in LOW state. FB_OUT is not affected by CLK_STP#. | Outputs enabled |

Table 3. Function Table (Bank A, B and C)

| VCO_SEL | SELA | QA(4:0) | SELB | QB(4:0) | SELC | QC(3:0) |
|---------|------|---------|------|---------|------|---------|
| 0 | 0 | ÷4 | 0 | ÷4 | 0 | ÷8 |
| 0 | 1 | ÷8 | 1 | ÷8 | 1 | ÷12 |
| 1 | 0 | ÷8 | 0 | ÷8 | 0 | ÷16 |
| 1 | 1 | ÷16 | 1 | ÷16 | 1 | ÷24 |

Table 4. Function Table (FB_OUT)

| VCO_SEL | FB_SEL1 | FB_SEL0 | FB_OUT |
|---------|---------|---------|--------|
| 0 | 0 | 0 | ÷8 |
| 0 | 0 | 1 | ÷16 |
| 0 | 1 | 0 | ÷12 |
| 0 | 1 | 1 | ÷24 |
| 1 | 0 | 0 | ÷16 |
| 1 | 0 | 1 | ÷32 |
| 1 | 1 | 0 | ÷24 |
| 1 | 1 | 1 | ÷48 |

Absolute Maximum Conditions

| Parameter | Description | Condition | Min. | Max. | Unit |
|------------------|-----------------------------------|-----------------------------|-------|-----------------------|-------|
| V _{DD} | DC Supply Voltage | | -0.3 | 5.5 | V |
| V _{DD} | DC Operating Voltage | Functional | 2.375 | 3.465 | V |
| V _{IN} | DC Input Voltage | Relative to V _{SS} | -0.3 | V _{DD} + 0.3 | V |
| V _{OUT} | DC Output Voltage | Relative to V _{SS} | -0.3 | V _{DD} + 0.3 | V |
| V _{TT} | Output termination Voltage | | - | V _{DD} ÷ 2 | V |
| LU | Latch Up Immunity | Functional | 200 | - | mA |
| R _{PS} | Power Supply Ripple | Ripple Frequency < 100 kHz | - | 150 | mVp-p |
| T _S | Temperature, Storage | Non Functional | -65 | +150 | °C |
| T _A | Temperature, Operating Ambient | Functional | -40 | +85 | °C |
| T _J | Temperature, Junction | Functional | - | 150 | °C |
| ∅ _{JC} | Dissipation, Junction to Case | Functional | - | 23 | °C/W |
| ∅ _{JA} | Dissipation, Junction to Ambient | Functional | - | 55 | °C/W |
| ESD _H | ESD Protection (Human Body Model) | | 2000 | - | Volts |
| FIT | Failure in Time | Manufacturing test | | 10 | ppm |

DC Electrical Specifications (V_{DD}= 2.5V ± 5%, T_A = -40°C to +85°C)

| Parameter | Description | Condition | Min. | Typ. | Max. | Unit |
|------------------|-------------------------------------|--|------|------|----------------------|------|
| V _{IL} | Input Voltage, Low | LVC MOS | - | - | 0.7 | V |
| V _{IH} | Input Voltage, High | LVC MOS | 1.7 | - | V _{DD} +0.3 | V |
| V _{OL} | Output Voltage, Low ^[4] | I _{OL} = 15 mA | - | - | 0.6 | V |
| V _{OH} | Output Voltage, High ^[4] | I _{OH} = -15 mA | 1.8 | - | - | V |
| I _{IL} | Input Current, Low ^[5] | V _{IL} = V _{SS} | - | - | -100 | μA |
| I _{IH} | Input Current, High ^[5] | V _{IL} = V _{DD} | - | - | - | μA |
| I _{DDA} | PLL Supply Current | A _{VDD} only | - | 5 | 10 | mA |
| I _{DDQ} | Quiescent Supply Current | All V _{DD} pins except A _{VDD} | - | - | 1 | mA |
| I _{DD} | Dynamic Supply Current | Outputs loaded @ 100 MHz | - | 135 | - | mA |
| C _{IN} | Input Pin Capacitance | | - | 4 | - | pF |
| Z _{OUT} | Output Impedance | | 14 | 18 | 22 | Ω |

DC Electrical Specifications (V_{DD}= 3.3V ± 5%, T_A = -40°C to +85°C)

| Parameter | Description | Condition | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------------|-----------------------------------|------|------|----------------------|------|
| V _{IL} | Input Voltage, Low | LVC MOS | - | - | 0.8 | V |
| V _{IH} | Input Voltage, High | LVC MOS | 2.0 | - | V _{DD} +0.3 | V |
| V _{OL} | Output Voltage, Low ^[4] | I _{OL} = 24 mA | - | - | 0.55 | V |
| | | I _{OL} = 12 mA | - | - | 0.30 | |
| V _{OH} | Output Voltage, High ^[4] | I _{OH} = -24 mA | 2.4 | - | - | V |
| I _{IL} | Input Current, Low ^[5] | V _{IL} = V _{SS} | - | - | -100 | μA |
| I _{IH} | Input Current, High ^[5] | V _{IL} = V _{DD} | - | - | 100 | μA |

Notes:

- Driving one 50Ω parallel terminated transmission line to a termination voltage of V_{TT}. Alternatively, each output drives up to two 50Ω series terminated transmission lines.
- Inputs have pull-up or pull-down resistors that affect the input current.

DC Electrical Specifications ($V_{DD} = 3.3V \pm 5\%$, $T_A = -40^\circ C$ to $+85^\circ C$) (continued)

| Parameter | Description | Condition | Min. | Typ. | Max. | Unit |
|-----------|--------------------------|------------------------------------|------|------|------|----------|
| I_{DDA} | PLL Supply Current | A_{VDD} only | – | 5 | 10 | mA |
| I_{DDQ} | Quiescent Supply Current | All V_{DD} pins except A_{VDD} | – | – | 1 | mA |
| I_{DD} | Dynamic Supply Current | Outputs loaded @ 100 MHz | – | 225 | – | mA |
| C_{IN} | Input Pin Capacitance | | – | 4 | – | pF |
| Z_{OUT} | Output Impedance | | 12 | 15 | 18 | Ω |

AC Electrical Specifications^[6] ($V_{DD} = 2.5V \pm 5\%$, $T_A = -40^\circ C$ to $+85^\circ C$)

| Parameter | Description | Condition | Min. | Typ. | Max. | Unit |
|-----------------|---|--|------|-----------|------|------|
| f_{VCO} | VCO Frequency | | 200 | – | 400 | MHz |
| f_{in} | Input Frequency | +8 Feedback | 25 | – | 50 | MHz |
| | | +12 Feedback | 16.6 | – | 33.3 | |
| | | +16 Feedback | 12.5 | – | 25 | |
| | | +24 Feedback | 8.3 | – | 16.6 | |
| | | +32 Feedback | 6.3 | – | 12.5 | |
| | | +48 Feedback | 4.2 | – | 8.3 | |
| | | Bypass mode (PLL_EN = 0) | 0 | – | 200 | |
| f_{refDC} | Input Duty Cycle | | 25 | – | 75 | % |
| t_r, t_f | TCLK Input Rise/Fall Time | 0.7V to 1.7V | – | – | 1.0 | ns |
| f_{MAX} | Maximum Output Frequency | +4 Output | 50 | – | 100 | MHz |
| | | +8 Output | 25 | – | 50 | |
| | | +12 Output | 16.6 | – | 33.3 | |
| | | +16 Output | 12.5 | – | 25 | |
| | | +24 Output | 8.3 | – | 16.6 | |
| DC | Output Duty Cycle | | 45 | – | 55 | % |
| t_r, t_f | Output Rise/Fall times | 0.7V to 1.8V | 0.1 | – | 1.0 | ns |
| $t_{(\phi)}$ | Propagation Delay (static phase offset) | TCLK to FB_IN, does not include jitter | –100 | – | 100 | ps |
| $t_{sk(O)}$ | Output-to-Output Skew | Skew within Bank | – | – | 150 | ps |
| tsk(B) | Bank-to-Bank Skew | Banks at same frequency | – | – | 150 | ps |
| | | Banks at different frequency | – | – | 225 | |
| $t_{PLZ, HZ}$ | Output Disable Time | | – | – | 10 | ns |
| $t_{PZL, ZH}$ | Output Enable Time | | – | – | 10 | ns |
| BW | PLL Closed Loop Bandwidth (–3 dB) | | – | 0.5 - 1.0 | – | MHz |
| $t_{JIT(CC)}$ | Cycle-to-Cycle Jitter | Same frequency | – | – | 150 | ps |
| | | Multiple frequencies | – | – | 300 | |
| $t_{JIT(PER)}$ | Period Jitter | | – | – | 100 | ps |
| $t_{JIT(\phi)}$ | I/O Phase Jitter | | – | – | 150 | ps |
| t_{LOCK} | Maximum PLL Lock Time | | – | – | 1 | ms |

Note:

6. AC characteristics apply for parallel output termination of 50 Ω to V_{TT} . Parameters are guaranteed by characterization and are not 100% tested.

AC Electrical Specifications^[6] ($V_{DD} = 3.3V \pm 5\%$, $T_A = -40^{\circ}C$ to $+85^{\circ}C$)

| Parameter | Description | Condition | Min. | Typ. | Max. | Unit |
|-----------------|---|--|------|-----------|--------|------|
| f_{VCO} | VCO Frequency | | 200 | – | 500 | MHz |
| f_{in} | Input Frequency | ÷8 Feedback | 25 | – | 62.5 | MHz |
| | | ÷12 Feedback | 16.6 | – | 41.6 | |
| | | ÷16 Feedback | 12.5 | – | 31.25 | |
| | | ÷24 Feedback | 8.3 | – | 20.8 | |
| | | ÷32 Feedback | 6.25 | – | 15.625 | |
| | | ÷48 Feedback | 4.2 | – | 10.4 | |
| | | Bypass mode (PLL_EN = 0) | 0 | – | 200 | |
| f_{refDC} | Input Duty Cycle | | 25 | – | 75 | % |
| t_r, t_f | TCLK Input Rise/FallTime | 0.8V to 2.0V | | – | 1.0 | ns |
| f_{MAX} | Maximum Output Frequency | ÷4 Output | 50 | – | 125 | MHz |
| | | ÷8 Output | 25 | – | 62.5 | |
| | | ÷12 Output | 16.6 | – | 41.6 | |
| | | ÷16 Output | 12.5 | – | 31.25 | |
| | | ÷24 Output | 8.3 | – | 20.8 | |
| DC | Output Duty Cycle | | 45 | – | 55 | % |
| t_r, t_f | Output Rise/Fall times | 0.8V to 2.4V | 0.1 | – | 1.0 | ns |
| $t_{(\phi)}$ | Propagation Delay (static phase offset) | TCLK to FB_IN, same V_{DD} , does not include jitter | –100 | – | 100 | ps |
| $t_{sk(O)}$ | Output-to-Output Skew | Skew within Bank | – | – | 150 | ps |
| $t_{sk(B)}$ | Bank-to-Bank Skew | Banks at same voltage, same frequency | – | – | 150 | ps |
| | | Banks at same voltage, different frequency | – | – | 225 | |
| | | Banks at different voltage | – | – | 250 | |
| $t_{PLZ, HZ}$ | Output Disable Time | | – | – | 10 | ns |
| $t_{PZL, ZH}$ | Output Enable Time | | – | – | 10 | ns |
| BW | PLL Closed Loop Bandwidth (–3dB) | | – | 0.5 - 1.0 | – | MHz |
| $t_{JIT(CC)}$ | Cycle-to-Cycle Jitter | Same frequency | – | – | 150 | ps |
| | | Multiple frequencies | – | – | 300 | |
| $t_{JIT(PER)}$ | Period Jitter | | – | – | 100 | ps |
| $t_{JIT(\phi)}$ | I/O Phase Jitter | I/O at same V_{DD} | – | – | 150 | ps |
| t_{LOCK} | Maximum PLL Lock Time | | – | – | 1 | ms |

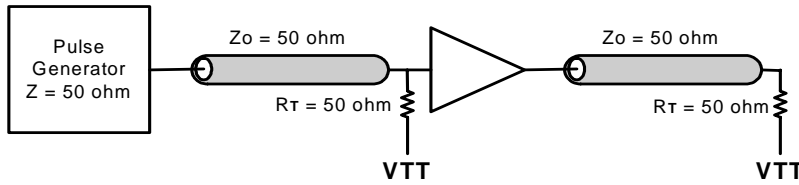


Figure 1. AC Test Reference for $V_{DD} = 3.3V / 2.5V$

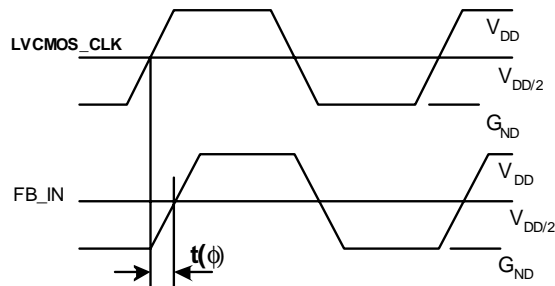


Figure 2. Propagation Delay $t(\phi)$, Static Phase Offset

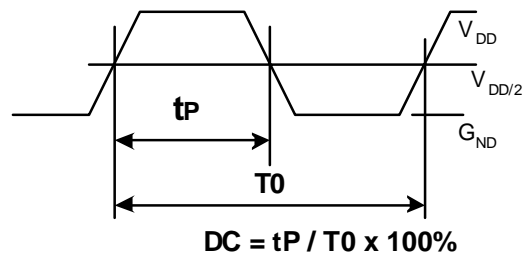


Figure 3. Output Duty Cycle (DC)

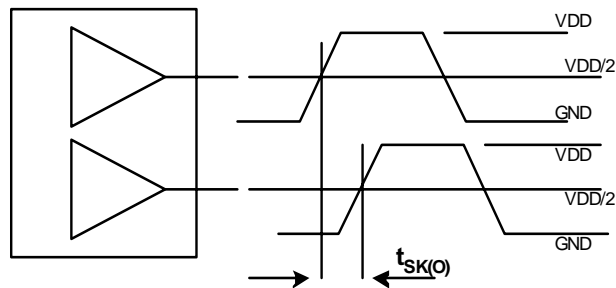


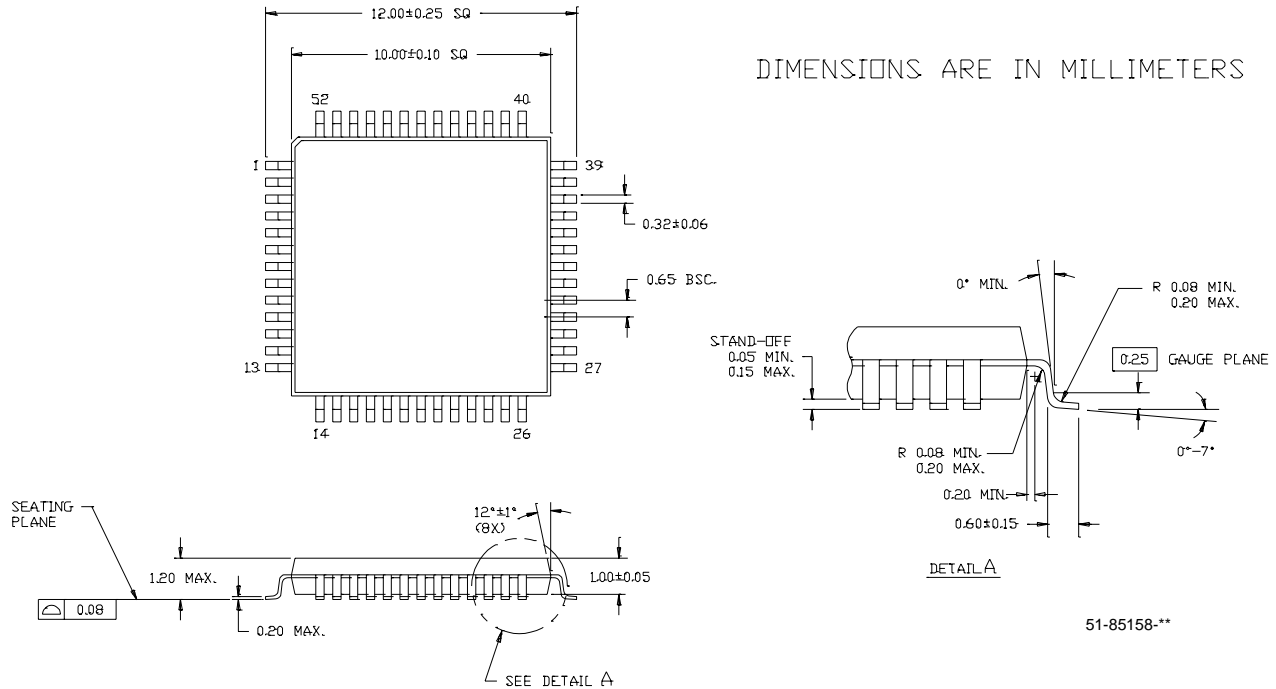
Figure 4. Output-to-Output Skew, $t_{sk(O)}$

Ordering Information

| Part Number | Package Type | Product Flow |
|-------------|----------------------------|----------------------------|
| CY29774AI | 52-pin TQFP | Industrial, -40°C to +85°C |
| CY29774AIT | 52-pin TQFP -Tape and Reel | Industrial, -40°C to 85°C |

Package Drawing and Dimension

52-Lead Thin Plastic Quad Flat Pack (10 x 10 x 1.0 mm) A52B



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Document History Page

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|--|---------|------------|-----------------|-----------------------|
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| ** | 125954 | 05/01/03 | RGL | New Data Sheet |