



GUARANTEED LOW SKEW CMOS CLOCK DRIVER/BUFFER

QS5805T/AT/BT

FEATURES:

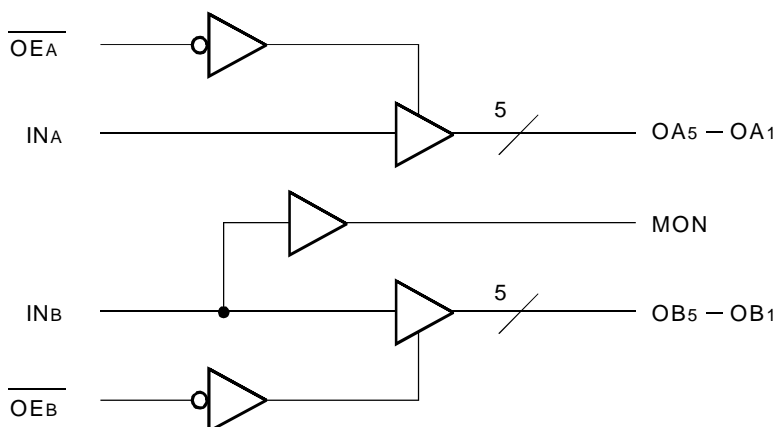
- 10 output, low skew signal buffer
- Guaranteed low skew:
 - 0.7ns output skew (same bank)
 - 0.9ns output skew (different bank)
 - 1ns part-to-part skew
- Input hysteresis for better noise margin
- Monitor output
- Undershoot clamp diodes on all inputs
- Std., A, and B speed grades
- Available in QSOP and SOIC packages

DESCRIPTION:

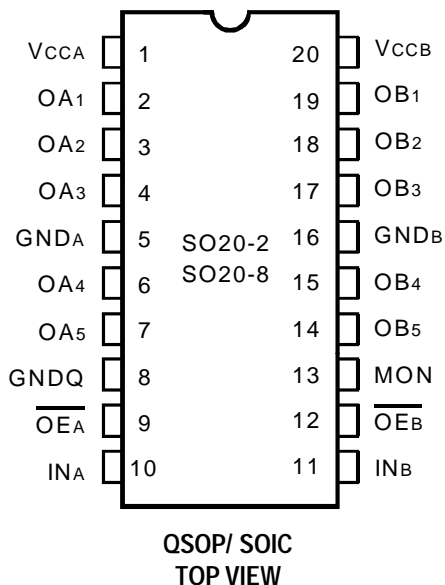
The QS5805T clock buffer/driver circuits can be used for clock buffering schemes where low skew is a key parameter. This device offers two banks of five non-inverting outputs. This device provides low propagation delay buffering with on-chip skew of 0.7ns for same-transition, same-bank signals.

The QS5805T is characterized for operation at -40°C to +85°C.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS ⁽¹⁾

| Symbol | Description | Max. | Unit |
|----------------------------------|--|--------------|------|
| V _{TERM} ⁽²⁾ | Supply Voltage to Ground | - 0.5 to +7 | V |
| | DC Output Voltage V _{OUT} | - 0.5 to +7 | V |
| V _{TERM} ⁽³⁾ | DC Input Voltage V _{IN} | - 0.5 to +7 | V |
| V _{AC} | AC Input Voltage (pulse width ≤20ns) | -3 | V |
| I _{OUT} | DC Input Diode Current V _{IN} < 0 | -20 | mA |
| | DC Output Current Max. Sink Current/Pin | 120 | mA |
| T _{STG} | Storage Temperature | - 65 to +150 | °C |
| T _J | Junction Temperature | 150 | °C |

NOTES:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
- Vcc Terminals.
- All terminals except Vcc.

CAPACITANCE (T_A = +25°C, f = 1.0MHz, V_{IN} = 0V)

| Pins | Typ. | Max. ⁽¹⁾ | Unit |
|------------------|------|---------------------|------|
| C _{IN} | 4 | 6 | pF |
| C _{OUT} | 7 | 9 | pF |

NOTE:

- This parameter is guaranteed but not production tested.

PIN DESCRIPTION

| Pin Names | I/O | Description |
|-------------------------------------|-----|---------------------------|
| $\overline{OE}A$, $\overline{OE}B$ | I | Output Enable Inputs |
| INA, INB | I | Clock Inputs |
| OAn, OBn | O | Clock Outputs |
| MON | O | Unbuffered Monitor Output |

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Industrial: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 5.0\text{V} \pm 10\%$

| Symbol | Parameter | Test Conditions | Min. | Typ. ⁽¹⁾ | Max. | Unit |
|--------------|--|---|------|---------------------|---------|---------------|
| V_{IH} | Input HIGH Voltage | Guaranteed Logic HIGH for All Inputs | 2 | — | — | V |
| V_{IL} | Input LOW Voltage | Guaranteed Logic LOW for All Inputs | — | — | 0.8 | V |
| V_{IC} | Clamp Diode Voltage ⁽³⁾ | $V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}$ | — | -0.7 | -1.2 | V |
| V_{OH} | Output HIGH Voltage | $V_{CC} = \text{Min.}, I_{OH} = -24\text{mA}$ | 2.4 | — | — | V |
| | | $V_{CC} = \text{Min.}, I_{OH} = -32\text{mA}$ | 2 | — | — | V |
| V_{OL} | Output LOW Voltage | $V_{CC} = \text{Min.}, I_{OL} = 64\text{mA}$ | — | — | 0.55 | V |
| I_{IN} | Input Leakage Current | $V_{CC} = \text{Max.}, V_{IN} = V_{CC}$ or GND | — | — | ± 1 | μA |
| I_{OFF} | Input/Output Power Off Leakage | $V_{CC} = 0\text{V}, V_{IN}$ or $V_{OUT} = V_{CC}$ or GND | — | — | ± 1 | μA |
| I_{OZ} | Output Leakage Current | $V_{CC} = \text{Max.}, V_{OUT} = V_{CC}$ or GND | — | — | ± 1 | μA |
| I_{OS} | Short Circuit Current ^(2,3) | $V_{CC} = \text{Max.}, V_{OUT} = \text{GND}$ | -60 | — | -250 | mA |
| ΔV_T | Input Hysteresis | $V_{TLH} - V_{THL}$ for All Inputs | — | 0.2 | — | V |

NOTES:

- Typical values are at $V_{CC} = 5.0\text{V}$, $T_A = 25^{\circ}\text{C}$.
- Not more than one output should be used to test this high power condition. Duration is less than one second.
- Guaranteed by design but not tested.

POWER SUPPLY CHARACTERISTICS

| Symbol | Parameter | Test Conditions ⁽¹⁾ | Typ. ⁽³⁾ | Max. | Unit | |
|-----------------|--|---|-----------------------------------|------|--------|----|
| I_{CC} | Quiescent Power Supply Current | $V_{CC} = \text{Max.}, V_{IN} = \text{GND}$ or V_{CC} | 0.005 | 0.5 | mA | |
| ΔI_{CC} | Supply Current per Input HIGH | $V_{CC} = \text{Max.}, V_{IN} = 3.4\text{V}, f_i = 0\text{MHz}$ | 1 | 2.5 | mA | |
| I_{CCD} | Dynamic Power Supply Current per Output ⁽²⁾ | $V_{CC} = \text{Max.}, V_{IN} = \text{GND}$ or V_{CC} Outputs Enabled, 50% duty cycle | 0.08 | 0.18 | mA/MHz | |
| I_C | Total Power Supply Current Examples ^(2,4) | $V_{CC} = \text{Max.},$ $\overline{OE_A} = \overline{OE_B} = \text{GND}$ 50% duty cycle, $f_i = 10\text{MHz}$ Five outputs toggling Unused inputs = GND or V_{CC} | $V_{IN} = \text{GND}$ or V_{CC} | 4 | 9.5 | mA |
| | | | $V_{IN} = \text{GND}$ or 3.4V | 4.5 | 10.8 | |
| | | $V_{CC} = \text{Max.},$ $\overline{OE_A} = \overline{OE_B} = \text{GND}$ 50% duty cycle, $f_i = 2.5\text{MHz}$ All outputs toggling | $V_{IN} = \text{GND}$ or V_{CC} | 2.2 | 5.5 | |
| | | | $V_{IN} = \text{GND}$ or 3.4V | 3.2 | 8 | |

NOTES:

- For conditions shown as Min. or Max., use the appropriate values specified under DC Electrical Characteristics.
- Guaranteed by design but not tested. $C_L = 0\text{pF}$.
- Typical values are for reference only. Conditions are $V_{CC} = 5.0\text{V}$, $T_A = 25^{\circ}\text{C}$.
- $I_C = I_{CC} + (\Delta I_{CC})(D_H)(N_T) + I_{CCD}(f_o)(N_o)$
 where:
 D_H = Input Duty Cycle
 N_T = Number of TTL HIGH inputs at D_H (one or two)
 f_o = Output Frequency
 N_o = Number of outputs at f_o

SKEW CHARACTERISTICS OVER OPERATING RANGE

T_A = -40°C to +85°C, V_{CC} = 5.0V ± 10%

C_{LOAD} = 50pF; R_{LOAD} = 500Ω

| Symbol | Parameter ⁽¹⁾ | QS5805T | | QS5805AT | | QS5805BT | | Unit |
|---------|--|---------|------|----------|------|----------|------|------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | |
| tsk(01) | Skew between two outputs, same transition, same bank | — | 0.7 | — | 0.7 | — | 0.7 | ns |
| tsk(02) | Skew between two outputs, same transition, different banks | — | 0.9 | — | 0.9 | — | 0.9 | ns |
| tsk(P) | Pulse Skew; opposite transition skew, same output (t _{PHL} - t _{PLH}) | — | 0.7 | — | 0.7 | — | 0.7 | ns |
| tsk(T) | Part-to-part skew ⁽²⁾ | — | 1.5 | — | 1 | — | 1 | ns |

NOTES:

1. Skew parameters are guaranteed across temperature range, but not tested. Skew parameters apply to propagation delays only.
2. tsk(T) only applies to devices of the same transition, part type, temperature, power supply voltage, loading, package, and speed grade.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

T_A = -40°C to +85°C, V_{CC} = 5.0V ± 10%

C_{LOAD} = 50pF; R_{LOAD} = 500Ω

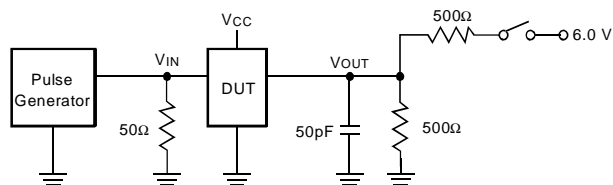
| Symbol | Parameter ⁽¹⁾ | QS52805T | | QS52805AT | | QS5805BT | | Unit |
|--------------------------------------|---|----------|------|-----------|------|----------|------|------|
| | | Min. | Max. | Min. | Max. | Min. | Max. | |
| t _{PLH} t _{PHL} | Propagation Delay ⁽²⁾ | 1.5 | 6.5 | 1.5 | 5.8 | 1.5 | 5 | ns |
| t _{PZL} t _{PZH} | Output Enable Time | 1.5 | 8 | 1.5 | 8 | 1.5 | 7 | ns |
| t _{PLZ} t _{PHZ} | Output Disable Time | 1.5 | 7 | 1.5 | 7 | 1.5 | 6 | ns |
| t _R | Output Rise Time, 0.8V to 2V ⁽³⁾ | — | 1.5 | — | 1.5 | — | 1.5 | ns |
| t _F | Output Fall Time, 2V to 0.8V ⁽³⁾ | — | 1.5 | — | 1.5 | — | 1.5 | ns |

NOTES:

1. Minimums guaranteed but not production tested.
2. The propagation delay other range indicated by Min. and Max. specifications results from process and environmental variables. These propagation delays do not imply limit skew.
3. This parameter is guaranteed but not tested.

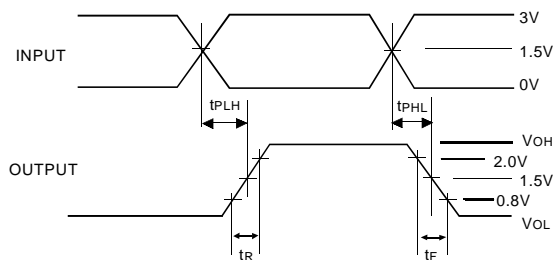
TEST CIRCUITS AND WAVEFORMS

| Parameter Tested | Switch Position |
|------------------|-----------------|
| tPLZ, tPZL | Closed |
| All Others | Open |

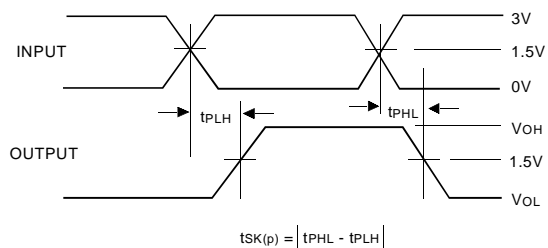


Pulse generator for all pulses: $f \leq 1.0\text{MHz}$; $t_f \leq 2.5\text{ns}$; $t_r \leq 2.5\text{ns}$

PROPAGATION DELAY

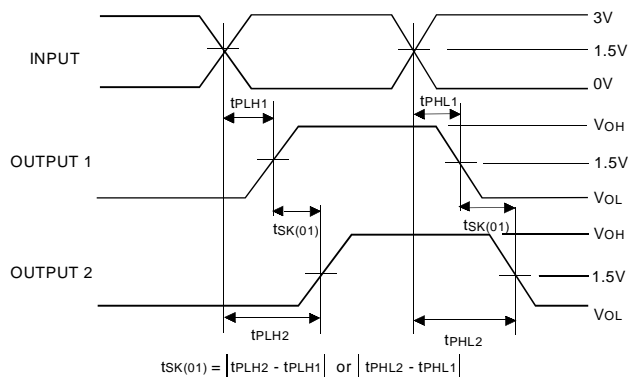


PULSE SKEW — tsk(p)



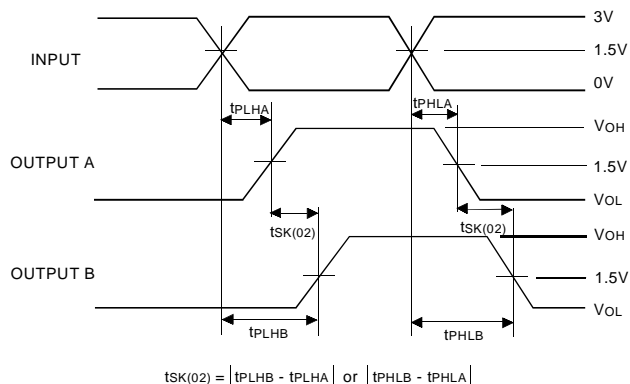
$$t_{sk(p)} = |t_{PHL} - t_{PLH}|$$

OUTPUT SKEW (SAME BANK) — tsk(01)



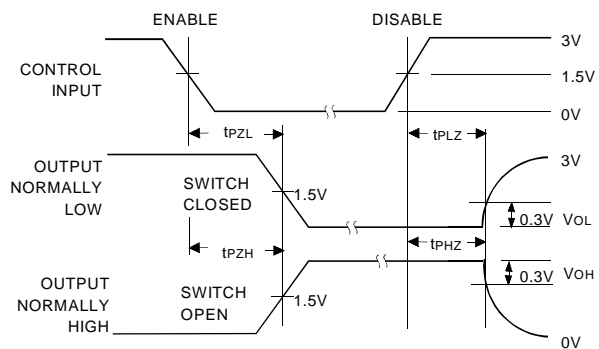
$$t_{sk(01)} = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

OUTPUT SKEW (DIFFERENT BANKS) — tsk(02)

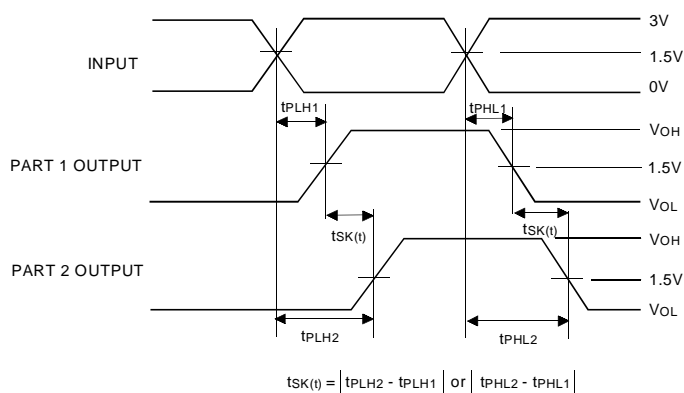


$$t_{sk(02)} = |t_{PLHB} - t_{PLHA}| \text{ or } |t_{PHLB} - t_{PHLA}|$$

ENABLE AND DISABLE TIMES



PART-TO-PART SKEW — tsk(i)



$$t_{sk(i)} = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

