GUARANTEED LOW SKEW 3.3V CMOS CLOCK DRIVER/BUFFER

QS53805/A

FEATURES:

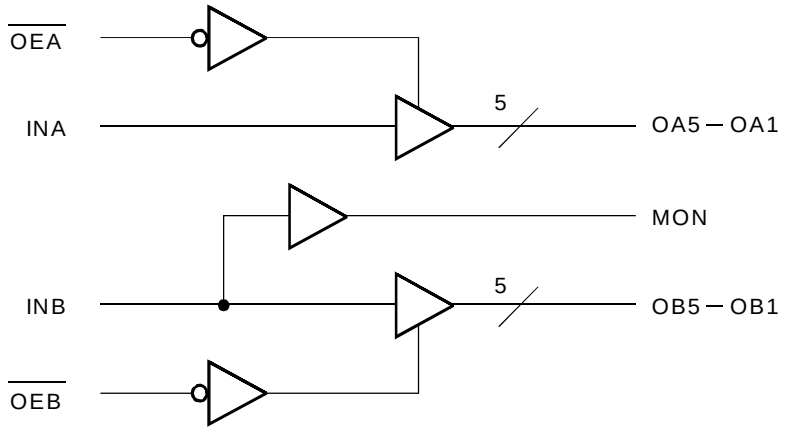
- 10 output, low skew clock signal buffer
- Pinout and function compatible with QS5805T
- JEDEC compatible LVTTL inputs and outputs
- Input hysteresis for better noise margin
- Monitor output
- Guaranteed low skew:
  - 0.7ns output skew
  - 1.1ns pulse skew
  - 1ns part-to-part skew
- Clock inputs are 5V tolerant
- Std. and A speed grades
- Available in QSOP and SOIC packages

DESCRIPTION

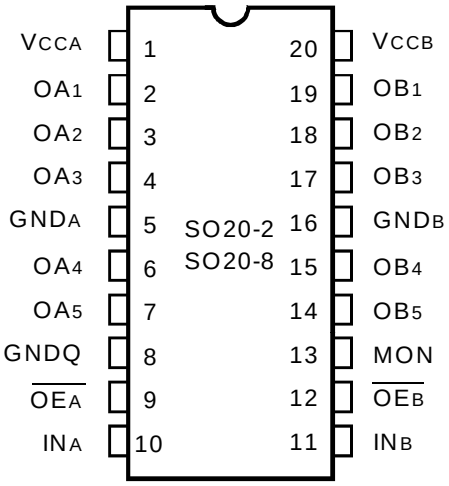
The QS53805 clock buffer/driver circuits can be used for clock buffering schemes where low skew is a key parameter. This device offers two banks of 5 non-inverting outputs. The QS53805 device provides low propagation delay buffering with on-chip skew of 0.7ns for same-transition, same-bank signals. This clock buffer product is designed for use in high performance workstations, embedded and personal computing systems using 3V to 3.6V supply voltages. Several can be used in parallel or scattered throughout a system for guaranteed low skew, system-wide clock distribution networks. The QS53805 can accept 5V input and control signals.

The QS53805 is characterized for operation at -40°C to +85°C.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



QSOP/ SOIC
TOP VIEW

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 Vcc+0.5	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 Output 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:
1. 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.
2. Vcc Terminals.
3. All terminals except Vcc.

CAPACITANCE

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

Pins	Typ.	Max. (1)	Unit
C_{IN}	4	6	pF
C_{OUT}	8	10	pF

NOTE:
1. This parameter is guaranteed but not production tested.

RECOMMENDED OPERATING CONDITIONS

Symbol	Description	Min.	Max	Unit
V_{CC}	Power Supply Voltage	3	3.6	V
V_{IN}	Input Voltage	0	5.5	V
V_{OUT}	Voltage Applied to Outputs	0	V_{CC}	V
T_A	Ambient Operating Temperature	– 40	85	°C

PIN DESCRIPTION

Pin Names	I/O	Description
$\overline{OEA}$, $\overline{OEB}$	I	Output Enable
INA, INB	I	Clock Inputs
$\overline{OAn}$, $\overline{OBn}$	O	Clock Outputs
$\overline{MON}$	O	Monitor Outputs (does not 3-state)

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Industrial: T_A = -40°C to +85°C, V_{CC} = 3.3V ± 0.3V

Symbol	Parameter	Test Conditions	Min.	Typ.(1)	Max.	Unit
V_{IH}	Input HIGH Voltage	Guaranteed Logic HIGH for Inputs	2	—	5.5	V
V_{IL}	Input LOW Voltage	Guaranteed Logic LOW for Inputs	–0.5	—	0.8	V
V_{IC}	Clamp Diode Voltage (3)	Vcc = Min., I_{IN} = -18mA	—	–0.7	–1.2	V
V_{OH}	Output HIGH Voltage	Vcc = Min., I_{OH} = -100µA	Vcc – 0.2	—	—	V
		Vcc = Min., I_{OH} = -8mA	2.4	—	—	V
V_{OL}	Output LOW Voltage	Vcc = Min., I_{OL} = 100µA	—	—	0.2	V
		Vcc = Min., I_{OL} = 16mA	—	—	0.4	V
		Vcc = Min., I_{OL} = 24mA	—	—	0.5	V
I_{IN}	Input Leakage Current	Vcc = Max., V_{IN} = Vcc or GND	—	—	±1	µA
I_{OZ}	Output Leakage Current	Vcc = Max., V_{OUT} = Vcc or GND	—	—	±1	µA
I_{OFF}	Input Power Off Leakage	Vcc = 0V, V_{IN} = Vcc or GND	—	—	±1	µA
I_{ODH}	Output HIGH Current (2)	Vcc = 3.3V, V_{IN} = V_{IH} or V_{IL}, V_O = 1.5V	–30	–100	–200	mA
I_{ODL}	Output LOW Current (2)	Vcc = 3.3V, V_{IN} = V_{IH} or V_{IL}, V_O = 1.5V	30	100	200	mA
I_{OS}	Short Circuit Current (2,3)	Vcc = Max., V_{OUT} = GND	– 60	—	—	mA

NOTES:
1. Typical values are at V_{CC} = 3.3V, T_A = 25°C.
2. Not more than one output should be used to test this high power condition. Duration is less than one second.
3. 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} = Max., V_{IN} = GND or Vcc		0.01	100	µA
ΔI_{CC}	Supply Current per Input HIGH	V_{CC} = Max., V_{IN} = Vcc – 0.6V, f = 0MHz		0.1	30	µA
I_{CCD}	Dynamic Power Supply Current per Output (2)	V_{CC} = Max., $\overline{OEA}$ = $\overline{OEB}$ = GND Outputs Toggling at 50% duty cycle		65	100	µA/MHz
I_C	Total Power Supply Current Examples (2,4)	V_{CC} = Max., $\overline{OEA}$ = $\overline{OEB}$ = GND 50% duty cycle, f_i = 10MHz five outputs	V_{IN} = GND or Vcc	3.5	5.2	mA
			V_{IN} = GND or 3V	3.5	5.2	mA
		V_{CC} = Max., $\overline{OEA}$ = $\overline{OEB}$ = GND 50% duty cycle, f_i = 2.5MHz All outputs toggling	V_{IN} = GND or Vcc	1.8	2.9	mA
			V_{IN} = GND or 3V	1.8	2.9	mA

NOTES:
1. For conditions shown as Min. or Max., use the appropriate values specified under DC Electrical Characteristics.
2. Guaranteed by design but not tested. C_L = 0pF.
3. Typical values are for reference only. Conditions are V_{CC} = 3.3V, T_A = 25°C.
4. $I_C = I_{CC} + (\Delta I_{CC})(D_H)(N_I) + I_{CCD}(f_O)(N_O)$
   where:
   D_H = Input Duty Cycle
   N_I = Number of TTL HIGH inputs at D_H
   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} = 3.3V ± 0.3V
C_{LOAD} = 50pF, R_{LOAD} = 500Ω unless otherwise noted.

Symbol	Parameter [1]	QS53805		QS53805A		Unit
		Min.	Max.	Min.	Max.	
$t_{SK(01)}$	Skew between all outputs, same transition, same bank	—	0.7	—	0.7	ns
$t_{SK(02)}$	Skew between two outputs, same transition, different banks	—	0.8	—	0.8	ns
$t_{SK(P)}$	Pulse Skew; skew between opposite transitions of the same output (t_{PHL} - t_{PLH})	—	1.1	—	1.1	ns
$t_{SK(T)}$	Part-to-part skew [2]	—	1.5	—	1	ns

NOTES:
1. This parameter is guaranteed but not production tested. Skew parameters apply to propagation delays only.
2. $t_{SK(T)}$ only applies to devices of the same transition, part type, temperature, power supply voltage, loading package, and speed grade.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

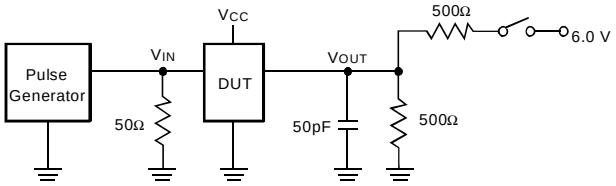
T_A = -40°C to +85°C, V_{CC} = 3.3V ± 0.3V
C_{LOAD} = 50pF, R_{LOAD} = 500Ω unless otherwise noted.

Symbol	Parameter [1,2]	QS53805		QS53805A		Unit
		Min.	Max.	Min.	Max.	
t_{PLH} t_{PHL}	Propagation Delay	1.5	6.5	1.5	5.8	ns
t_R	Output Rise Time, 0.8V to 2V [3]	—	2	—	2	ns
t_F	Output Fall Time, 2V to 0.8V [3]	—	2	—	2	ns
t_{PZL} t_{PZH}	Output Enable Time	1.5	8	1.5	8	ns
t_{PLZ} t_{PHZ}	Output Disable Time	1.5	7	1.5	7	ns

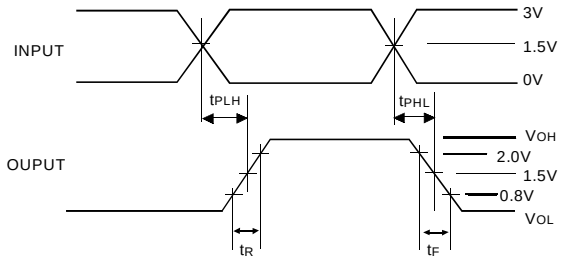
NOTES:
1. Minimums guaranteed but not production tested.
2. The propagation delay other range indicated by Min. and Max. specifications results from process and environmental variables. These propagation delays do not imply limit skew.
3. This parameter is guaranteed but not production tested.

TEST CIRCUITS AND WAVEFORMS

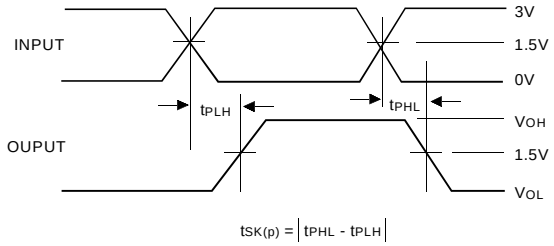
Parameter Tested	Switch Position
t_{PLZ}, t_{PZL}	Closed
All Others	Open



Pulse generator for all pulses: $f \leq 1.0MHz$; $t_F \leq 2.5ns$; $t_R \leq 2.5ns$

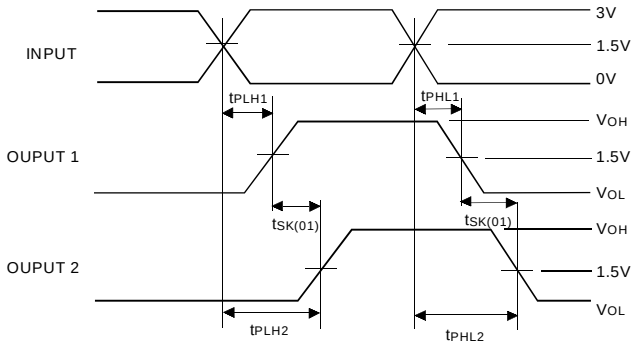


PROPAGATION DELAY



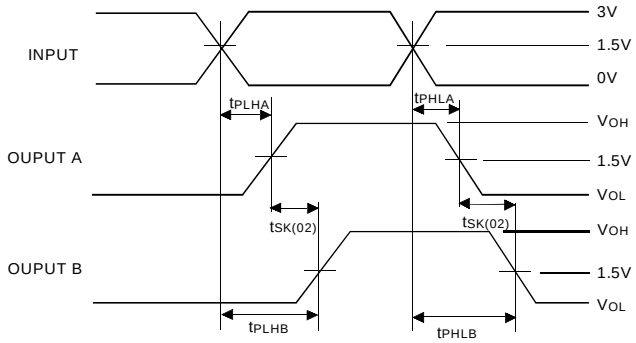
$t_{SK(p)} = |t_{PHL} - t_{PLH}|$

PULSE SKEW — $t_{SK(P)}$



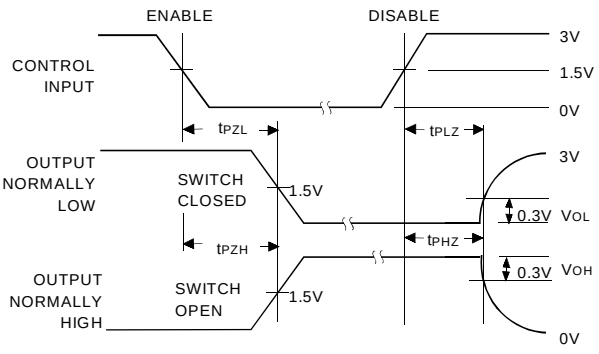
$t_{SK(01)} = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$

OUTPUT SKEW (SAME BANK) — $t_{SK(01)}$

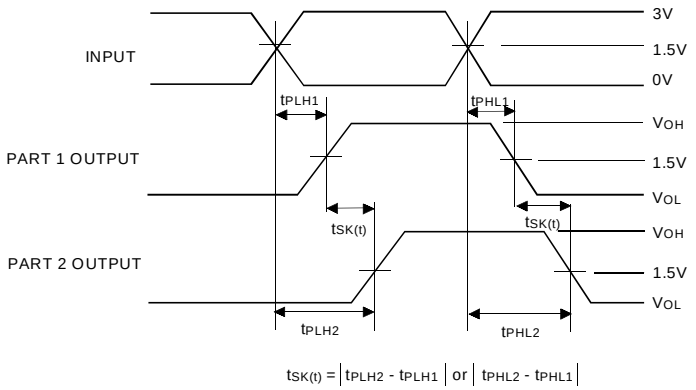


$t_{SK(02)} = |t_{PLHB} - t_{PLHA}|$ or $|t_{PHLB} - t_{PHLA}|$

OUPUT SKEW (DIFFERENT BANKS) — $t_{SK(02)}$



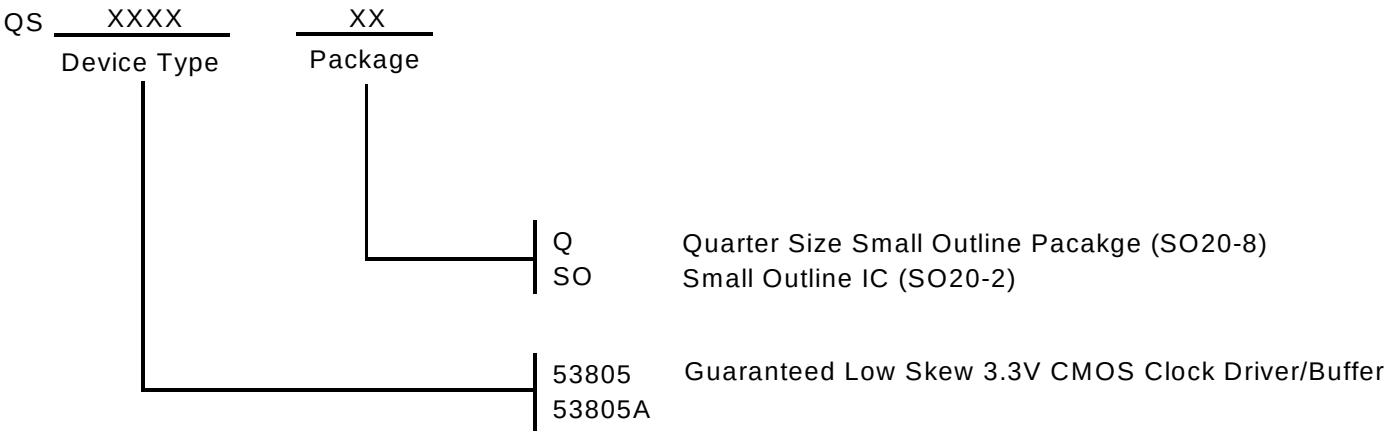
ENABLE AND DISABLE TIMES



$t_{SK(t)} = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$

PART-TO-PART SKEW — $t_{SK(T)}$

ORDERING INFORMATION



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