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3.3V CMOS BUFFER/CLOCK DRIVER

IDT49FCT3805/A

FEATURES:

- 0.5 MICRON CMOS Technology
- Guaranteed low skew < 500ps (max.)
- Very low duty cycle distortion < 1.0ns (max.)
- Very low CMOS power levels
- TTL compatible inputs and outputs
- Inputs can be driven from 3.3V or 5V components
- Two independent output banks with 3-state control
- 1:5 fanout per bank
- "Heartbeat" monitor output
- V_{CC} = 3.3V ± 0.3V
- Available in SSOP, SOIC, and QSOP packages

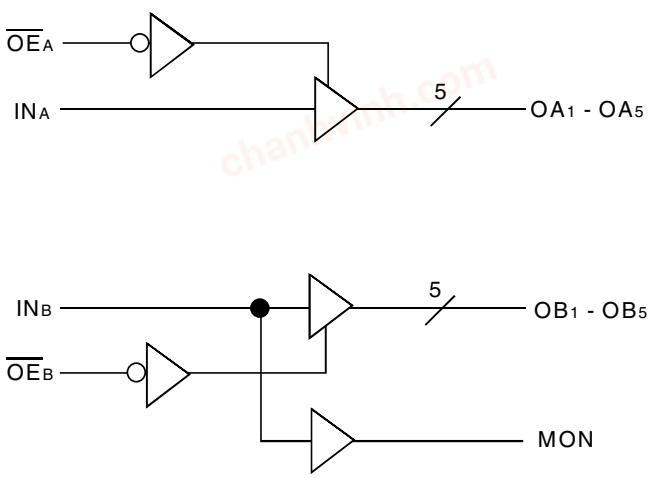
DESCRIPTION:

The FCT3805 is a 3.3 volt, non-inverting clock driver built using advanced dual metal CMOS technology. The device consists of two banks of drivers, each with a 1:5 fanout and its own output enable control. The device has a "heartbeat" monitor for diagnostics and PLL driving. The MON output is identical to all other outputs and complies with the output specifications in this document. The FCT3805 offers low capacitance inputs with hysteresis.

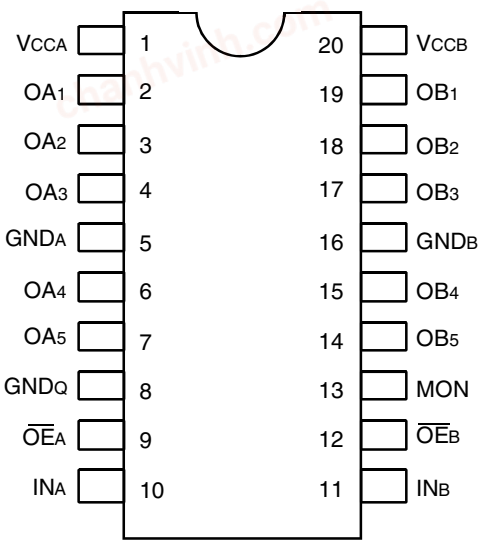
The FCT3805 is designed for high speed clock distribution where signal quality and skew are critical. The FCT3805 also allows single point-to-point transmission line driving in applications such as address distribution, where one signal must be distributed to multiple recievers with low skew and high signal quality.

For more information on using the FCT3805 with two different input frequencies on bank A and B, please see AN-236.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



SOIC/ SSOP/ QSOP
TOP VIEW

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ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Description	Max	Unit
V_{TERM}(2)	Terminal Voltage with Respect to GND	–0.5 to +4.6	V
V_{TERM}(3)	Terminal Voltage with Respect to GND	–0.5 to +7	V
V_{TERM}(4)	Terminal Voltage with Respect to GND	–0.5 to V_{CC}+0.5	V
T_{STG}	Storage Temperature	–65 to +150	°C
I_{OUT}	DC Output Current	–60 to +60	mA

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. V_{CC} terminals.
3. Input terminals.
4. Outputs and I/O terminals.

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter(1)	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	4.5	6	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	5.5	8	pF

NOTE:
1. This parameter is measured at characterization but not tested.

PIN DESCRIPTION

Pin Names	Description
$\overline{OE}_A$, $\overline{OE}_B$	3-State Output Enable Inputs (Active LOW)
IN_A, IN_B	Clock Inputs
OAn, OBn	Clock Outputs
MON	Monitor Output

FUNCTION TABLE (1)

Inputs		Outputs	
$\overline{OE}_A$, $\overline{OE}_B$	IN_A, IN_B	OAn, OBn	MON
L	L	L	L
L	H	H	H
H	L	Z	L
H	H	Z	H

NOTE:
1. H = HIGH
   L = LOW
   Z = High-Impedance

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DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified
Commercial: T_A = 0°C to +70°C, Industrial: T_A = -40°C to +85°C, V_{CC} = 3.3V ± 0.3V

Symbol	Parameter	Test Conditions[1]		Min.	Typ.	Max.	Unit
V_{IH}	Input HIGH Level (Input pins)	Guaranteed Logic HIGH Level		2	—	5.5	V
	Input HIGH Level (I/O pins)			2	—	V_{CC} + 0.5	
V_{IL}	Input LOW Level (Input and I/O pins)	Guaranteed Logic LOW Level		–0.5	—	0.8	V
I_{IH}	Input HIGH Current (Input pins)	V_{CC} = Max.	V_I = 5.5V	—	—	±1	µA
	Input HIGH Current (I/O pins)		V_I = V_{CC}	—	—	±1	
I_{IL}	Input LOW Current (Input pins)	V_{CC} = Max.	V_I = GND	—	—	±1	
	Input LOW Current (I/O pins)		V_I = GND	—	—	±1	
I_{OZH}	High Impedence Output Current	V_{CC} = Max.	V_O = V_{CC}	—	—	±1	µA
I_{OZL}	(3-State Output Pins)		V_O = GND	—	—	±1	
V_{IK}	Clamp Diode Voltage	V_{CC} = Min., I_{IN} = –18mA		—	–0.7	–1.2	V
I_{ODH}	Output HIGH Current	V_{CC} = 3.3V, V_{IN} = V_{IH} or V_{IL}, V_O = 1.5V[3]		–36	–60	–110	mA
I_{ODL}	Output LOW Current	V_{CC} = 3.3V, V_{IN} = V_{IH} or V_{IL}, V_O = 1.5V[3]		50	90	200	mA
V_{OH}	Output HIGH Voltage	V_{CC} = Min.	I_{OH} = –0.1mA	V_{CC}–0.2	—	—	V
		V_{IN} = V_{IH} or V_{IL}	I_{OH} = –8mA	2.4[5]	3	—	
V_{OL}	Output LOW Voltage	V_{CC} = Min.	I_{OL} = 0.1mA	—	—	0.2	V
		V_{IN} = V_{IH} or V_{IL}	I_{OL} = 16mA	—	0.2	0.4	
			I_{OL} = 24mA	—	0.3	0.5	
I_{OFF}	Input Power Off Leakage	V_{CC} = 0V, V_{IN} = 4.5V		—	—	±1	µA
I_{OS}	Short Circuit Current[4]	V_{CC} = Max., V_O = GND[3]		–60	–135	–240	mA
V_H	Input Hysteresis	—		—	150	—	mV
I_{CCL}	Quiescent Power Supply Current	V_{CC} = Max.		—	0.1	10	µA
I_{CCH}		V_{IN} = GND or V_{CC}					
I_{CCZ}							

NOTES:

1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at Vcc = 3.3V, +25°C ambient.
3. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
4. This parameter is guaranteed but not tested.
5. V_{OH} = Vcc - 0.6V at rated current.

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POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]		Min.	Typ.[2]	Max.	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	V_{CC} = Max. $V_{IN} = V_{CC} - 0.6V$[3]		—	10	30	µA
I_{CCD}	Dynamic Power Supply Current[4]	V_{CC} = Max. Outputs Open $\overline{OEA}$ = $\overline{OEB}$ = GND Per Output Toggling 50% Duty Cycle	$V_{IN} = V_{CC}$ V_{IN} = GND	—	0.035	0.06	mA/MHz
I_C	Total Power Supply Current[6]	V_{CC} = Max. Outputs Open fo = 25MHz 50% Duty Cycle $\overline{OEA}$ = $\overline{OEB}$ = V_{CC} Mon. Output Toggling	$V_{IN} = V_{CC}$ V_{IN} = GND	—	0.9	1.6	mA
			$V_{IN} = V_{CC} - 0.6V$ V_{IN} = GND	—	0.9	1.6	
		V_{CC} = Max. Outputs Open fo = 50MHz 50% Duty Cycle $\overline{OEA}$ = $\overline{OEB}$ = GND Eleven Outputs Toggling	$V_{IN} = V_{CC}$ V_{IN} = GND	—	20	33[5]	
			$V_{IN} = V_{CC} - 0.6V$ V_{IN} = GND	—	20	33[5]	

NOTES:

1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{CC} = 3.3V, +25°C ambient.
3. Per TTL driven input ($V_{IN} = V_{CC} - 0.6V$); all other inputs at V_{CC} or GND.
4. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
5. Values for these conditions are examples of the I_C formula. These limits are guaranteed but not tested.
6. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_O N_O)$
   I_{CC} = Quiescent Current (I_{CCL}, I_{CCH} and I_{CCZ})
   ΔI_{CC} = Power Supply Current for a TTL High Input ($V_{IN} = V_{CC} - 0.6V$)
   D_H = Duty Cycle for TTL Inputs High
   N_T = Number of TTL Inputs at D_H
   I_{CCD} = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
   f_O = Output Frequency
   N_O = Number of Outputs at f_O
   All currents are in milliamps and all frequencies are in megahertz.

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SWITCHING CHARACTERISTICS OVER OPERATING RANGE - COMMERCIAL(3,4)

Symbol	Parameter	Conditions(1)	FCT3805		FCT3805A		Unit
			Min.(2)	Max.	Min.(2)	Max.	
t_{PLH} t_{PHL}	Propagation Delay IN_A to OAn, IN_B to OBn	C_L = 50pF R_L = 500Ω	1.5	5.8	1.5	5	ns
t_R	Output Rise Time		—	2	—	2	ns
t_F	Output Fall Time		—	2	—	2	ns
$t_{SK(O)}$	Output skew: skew between outputs of all banks of same package (inputs tied together)		—	0.5	—	0.5	ns
$t_{SK(P)}$	Pulse skew: skew between opposite transitions of same output ($\lvert t_{PHL} - t_{PLH} \rvert$)		—	1	—	1	ns
$t_{SK(T)}$	Package skew: skew between outputs of different packages being driven by the same input source, power supply voltage, temperature, frequency, and speed grade.		—	1.5	—	1.2	ns
t_{PZL} t_{PZH}	Output Enable Time $\overline{OE_A}$ to OAn, $\overline{OE_B}$ to OBn		1.5	6.5	1.5	6	ns
t_{PLZ} t_{PHZ}	Output Disable Time $\overline{OE_A}$ to OAn, $\overline{OE_B}$ to OBn		1.5	5.5	1.5	5	ns

SWITCHING CHARACTERISTICS OVER OPERATING RANGE - INDUSTRIAL(3,4)

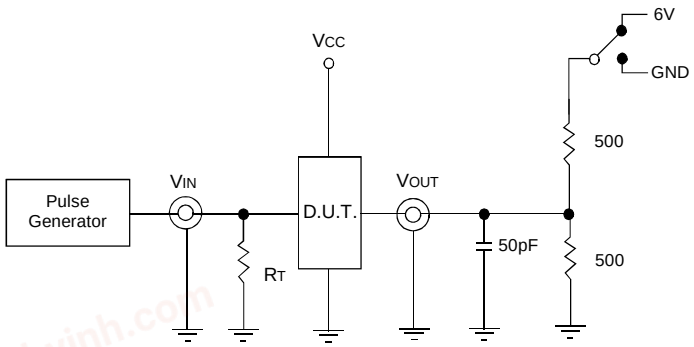
Symbol	Parameter	Conditions(1)	FCT3805		FCT3805A		Unit
			Min.(2)	Max.	Min.(2)	Max.	
t_{PLH} t_{PHL}	Propagation Delay IN_A to OAn, IN_B to OBn	C_L = 50pF R_L = 500Ω	1.5	5.8	1.5	5.2	ns
t_R	Output Rise Time		—	2	—	2	ns
t_F	Output Fall Time		—	2	—	2	ns
$t_{SK(O)}$	Output skew: skew between outputs of all banks of same package (inputs tied together)		—	0.6	—	0.6	ns
$t_{SK(P)}$	Pulse skew: skew between opposite transitions of same output ($\lvert t_{PHL} - t_{PLH} \rvert$)		—	1	—	1	ns
$t_{SK(T)}$	Package skew: skew between outputs of different packages being driven by the same input source, power supply voltage, temperature, frequency, and speed grade.		—	1.5	—	1.2	ns
t_{PZL} t_{PZH}	Output Enable Time $\overline{OE_A}$ to OAn, $\overline{OE_B}$ to OBn		1.5	6.5	1.5	6	ns
t_{PLZ} t_{PHZ}	Output Disable Time $\overline{OE_A}$ to OAn, $\overline{OE_B}$ to OBn		1.5	5.5	1.5	5	ns

NOTES:
1. See test circuits and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. t_{PLH}, t_{PHL}, $t_{SK}(t)$ are production tested. All other parameters guaranteed but not production tested.
4. Propagation delay range indicated by Min. and Max. limit is due to V_{CC}, operating temperature and process parameters. These propagation delay limits do not imply skew.

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TEST CIRCUITS AND WAVEFORMS

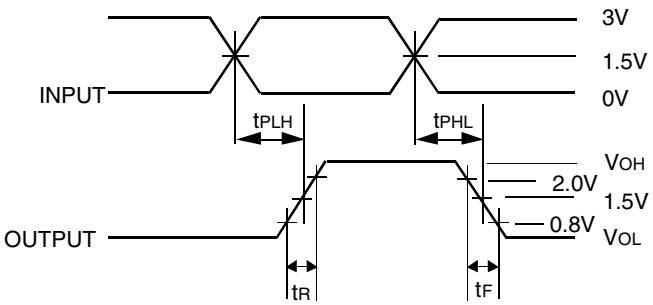


Test Circuits for All Outputs

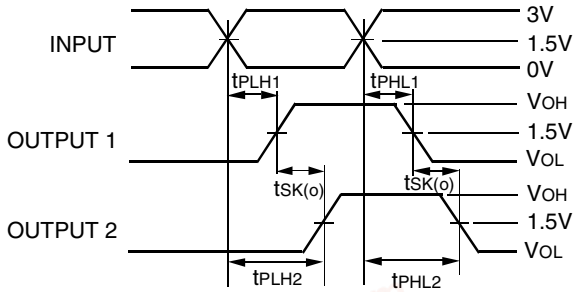
SWITCH POSITION

Test	Switch
Disable LOW Enable LOW	6V
Disable HIGH Enable HIGH	GND

DEFINITIONS:
C_L = Load capacitance: includes jig and probe capacitance.
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

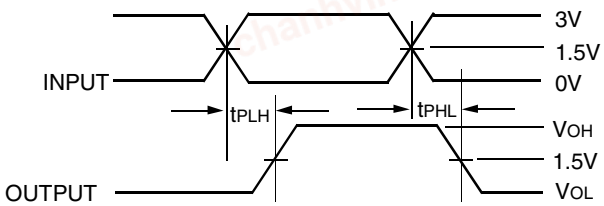


Package Delay



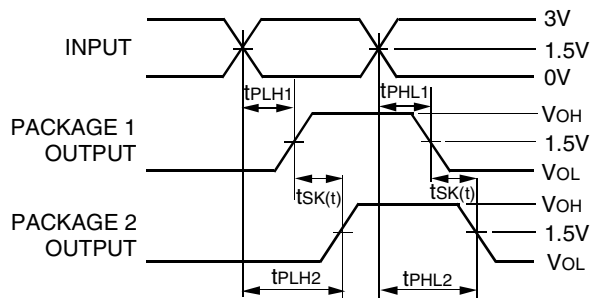
$t_{SK(o)} = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$

Output Skew - $t_{SK(O)}$



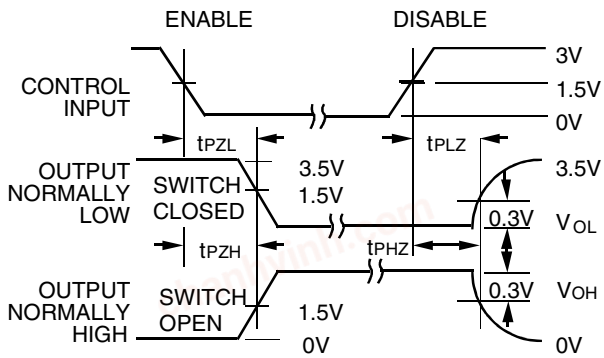
$t_{SK(p)} = |t_{PHL} - t_{PLH}|$

Pulse Skew - $t_{SK(P)}$



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

Package Skew - $t_{SK(T)}$



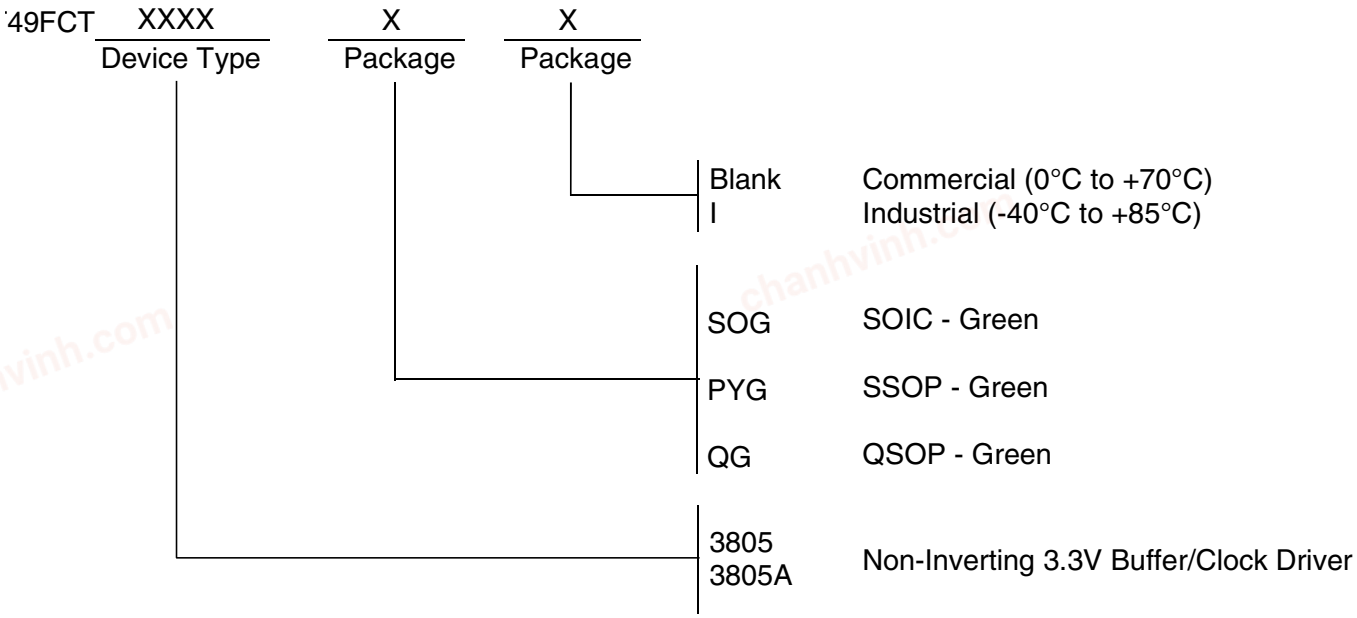
Output Skew - $t_{SK(X)}$

NOTES:
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH
2. Pulse Generator for All Pulses: f ≤1.0MHz; t_F ≤2.5ns; t_R ≤2.5ns

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