



Integrated Device Technology, Inc.

FAST CMOS BUFFER/CLOCK DRIVER

IDT54/74FCT810BT/CT

FEATURES:

- 0.5 MICRON CMOS technology
- Guaranteed low skew < 600ps (max.)
- Very low duty cycle distortion < 700ps (max.)
- Low CMOS power levels
- TTL compatible inputs and outputs
- TTL level output voltage swings
- High drive: -32mA IOH, 48mA IOL
- Two independent output banks with 3-state control
 - One 1:5 Inverting bank
 - One 1:5 Non-Inverting bank
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- Available in DIP, SOIC, SSOP, QSOP, CERPACK and

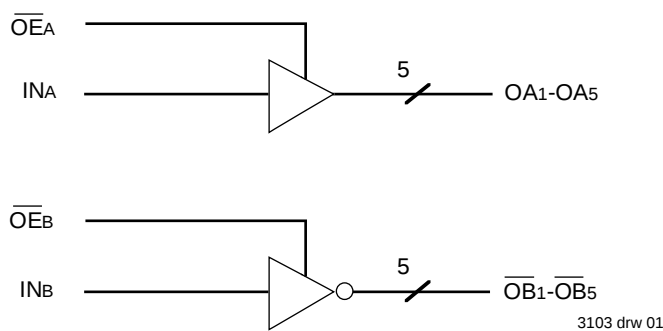
LCC packages

- Military product compliant to MIL-STD-883, Class B

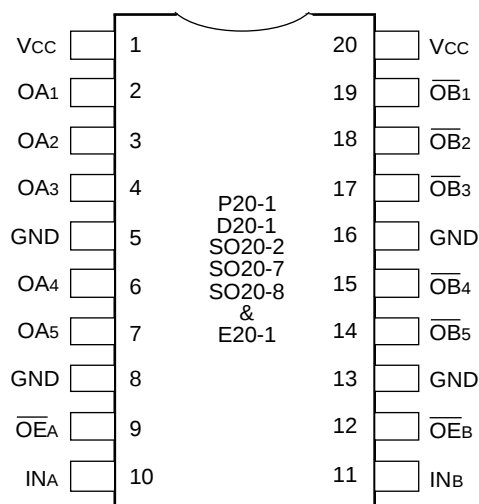
DESCRIPTION:

The IDT54/74FCT810BT/CT is a dual bank inverting/ non-inverting clock driver built using advanced dual metal CMOS technology. It consists of two banks of drivers, one inverting and one non-inverting. Each bank drives five output buffers from a standard TTL-compatible input. The IDT54/74FCT810BT/CT have low output skew, pulse skew and package skew. Inputs are designed with hysteresis circuitry for improved noise immunity. The outputs are designed with TTL output levels and controlled edge rates to reduce signal noise. The part has multiple grounds, minimizing the effects of ground inductance.

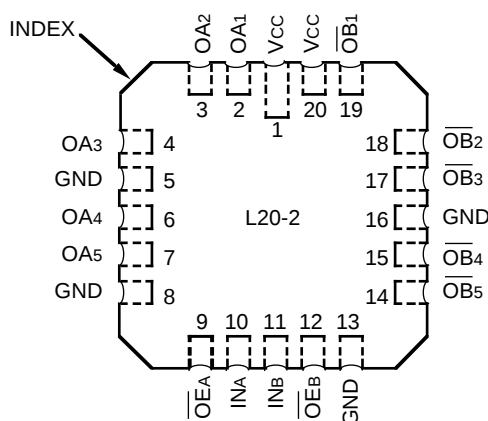
FUNCTIONAL BLOCK DIAGRAMS



PIN CONFIGURATIONS



DIP/SOIC/SSOP/QSOP/CERPACK
TOP VIEW



LCC
TOP VIEW

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MILITARY AND COMMERCIAL TEMPERATURE RANGES

OCTOBER 1995

PIN DESCRIPTION

Pin Names	Description
$\overline{OE}_A, \overline{OE}_B$	3-State Output Enable Inputs (Active LOW)
INA, IN_B	Clock Inputs
$OAn, \overline{OB}_n$	Clock Outputs

3103 tbl 01

CAPACITANCE ($T_A = +25^\circ\text{C}$, $f = 1.0\text{MHz}$)

Symbol	Parameter ⁽¹⁾	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	$V_{IN} = 0V$	4.5	6.0	pF
C_{OUT}	Output Capacitance	$V_{OUT} = 0V$	5.5	8.0	pF

NOTE:

3103 Ink 02

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

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Rating	Commercial	Military	Unit
$V_{TERM}^{(2)}$	Terminal Voltage with Respect to GND	-0.5 to +7.0	-0.5 to +7.0	V
$V_{TERM}^{(3)}$	Terminal Voltage with Respect to GND	-0.5 to V_{CC} +0.5	-0.5 to V_{CC} +0.5	V
T_A	Operating Temperature	0 to +70	-55 to +125	$^\circ\text{C}$
T_{BIAS}	Temperature Under Bias	-55 to +125	-65 to +135	$^\circ\text{C}$
T_{STG}	Storage Temperature	-55 to +125	-65 to +150	$^\circ\text{C}$
I_{OUT}	DC Output Current	-60 to +120	-60 to +120	mA

NOTES:

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- 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. No terminal voltage may exceed V_{CC} by +0.5V unless otherwise noted.
- Input and V_{CC} terminals.
- Output and I/O terminals.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified

Commercial: $T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$, $V_{CC} = 5.0V \pm 5\%$; Military: $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{CC} = 5.0V \pm 10\%$

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Typ. ⁽²⁾	Max.	Unit
V_{IH}	Input HIGH Level	Guaranteed Logic HIGH Level		2.0	—	—	V
V_{IL}	Input LOW Level	Guaranteed Logic LOW Level		—	—	0.8	V
I_{IH}	Input HIGH Current ⁽⁵⁾	$V_{CC} = \text{Max.}$	$V_I = 2.7V$	—	—	± 1	μA
I_{IL}	Input LOW Current ⁽⁵⁾	$V_{CC} = \text{Max.}$	$V_I = 0.5V$	—	—	± 1	μA
I_{OZH}	High Impedance Output Current (3-State Output pins) ⁽⁵⁾	$V_{CC} = \text{Max.}$	$V_O = 2.7V$	—	—	± 1	μA
I_{OZL}			$V_O = 0.5V$	—	—	± 1	μA
I_I	Input HIGH Current ⁽⁵⁾	$V_{CC} = \text{Max.}$, $V_I = V_{CC} (\text{Max.})$		—	—	± 1	μA
V_{IK}	Clamp Diode Voltage	$V_{CC} = \text{Min.}$, $I_{IN} = -18\text{mA}$		—	-0.7	-1.2	V
I_{OS}	Short Circuit Current	$V_{CC} = \text{Max.}^{(3)}$, $V_O = \text{GND}$		-60	-120	-225	mA
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -12\text{mA MIL.}$ $I_{OH} = -15\text{mA COM'L.}$	2.4	3.3	—	V
			$I_{OH} = -24\text{mA MIL.}$ $I_{OH} = -32\text{mA COM'L.}^{(4)}$	2.0	3.0	—	
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 32\text{mA MIL.}$ $I_{OL} = 48\text{mA COM'L.}$	—	0.3	0.55	V
I_{OFF}	Input/Output Power Off Leakage ⁽⁵⁾	$V_{CC} = 0V$, V_{IN} or $V_O \leq 4.5V$		—	—	± 1	μA
V_H	Input Hysteresis for all inputs	—		—	150	—	mV
I_{CCL} I_{CCH} I_{CCZ}	Quiescent Power Supply Current	$V_{CC} = \text{Max.}$, $V_{IN} = \text{GND}$ or V_{CC}		—	5	500	μA

NOTES:

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- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $V_{CC} = 5.0V$, $+25^\circ\text{C}$ ambient.
- Not more than one output should be tested at one time. Duration of the test should not exceed one second.
- Duration of the condition can not exceed one second.
- The test limit for this parameter is $\pm 5\mu\text{A}$ at $T_A = -55^\circ\text{C}$.

POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Typ. ⁽²⁾	Max.	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	$V_{CC} = \text{Max.}$ $V_{IN} = 3.4V^{(3)}$		—	0.5	2.0	mA
I_{CCD}	Dynamic Power Supply Current ⁽⁴⁾	$V_{CC} = \text{Max.}$ Outputs Open $\overline{OE}_A = \overline{OE}_B = \text{GND}$ 50% Duty Cycle	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	60	100	$\mu A/\text{MHz/bit}$
I_C	Total Power Supply Current ⁽⁶⁾	$V_{CC} = \text{Max.}$ Outputs Open $f_o = 25\text{MHz}$ 50% Duty Cycle $\overline{OE}_A = \text{GND}, \overline{OE}_B = V_{CC}$	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	7.5	13	mA
			$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	—	7.8	14.0	
		$V_{CC} = \text{Max.}$ Outputs Open $f_o = 50\text{MHz}$ 50% Duty Cycle $\overline{OE}_A = \overline{OE}_B = \text{GND}$	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	30.0	50.5 ⁽⁵⁾	
			$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	—	30.5	52.5 ⁽⁵⁾	

NOTES:

3103 tbl 05

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $V_{CC} = 5.0V$, $+25^\circ\text{C}$ ambient.
- Per TTL driven input; ($V_{IN} = 3.4V$); all other inputs at V_{CC} or GND .
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed but not tested.
- $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_o N_o)$
 $I_{CC} = \text{Quiescent Current (} I_{CCL}, I_{CCH} \text{ and } I_{CCZ} \text{)}$
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input (} V_{IN} = 3.4V \text{)}$
 $D_H = \text{Duty Cycle for TTL Inputs High}$
 $N_T = \text{Number of TTL Inputs at } D_H$
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$
 $f_o = \text{Output Frequency}$
 $N_o = \text{Number of Outputs at } f_o$
 All currents are in milliamps and all frequencies are in megahertz.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE^(3,4)

Symbol	Parameter	Condition ⁽¹⁾	IDT54/74FCT810BT				IDT54/74FCT810CT				Unit
			Com'l.		Mil.		Com'l.		Mil.		
			Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	
tPLH	Propagation Delay	CL = 50pF RL = 500Ω	1.5	4.5	1.5	4.9	1.5	4.3	1.5	4.6	ns
tPHL	INA to OAn, INB to $\overline{OBn}$		—	1.5	—	2.0	—	1.5	—	2.0	ns
tR	Output Rise Time		—	1.5	—	1.5	—	1.5	—	1.5	ns
tF	Output Fall Time		—	0.5	—	0.9	—	0.3	—	0.7	ns
tsk1(o)	Output skew (same bank): skew between outputs of same bank and same package (same transition)		—	0.7	—	1.1	—	0.6	—	1.0	ns
tsk2(o)	Output skew (all banks): skew between outputs of all banks of same package (inputs tied together)		—	0.7	—	1.2	—	0.7	—	1.1	ns
tsk(p)	Pulse skew: skew between opposite transitions of same output (tPHL-tPLH)		—	1.2	—	1.5	—	1.0	—	1.2	ns
tsk(t)	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade		1.5	6.0	1.5	6.5	1.5	5.0	1.5	6.0	ns
tPZL tPZH	Output Enable Time $\overline{OE_A}$ to OAn, $\overline{OE_B}$ to $\overline{OBn}$		1.5	6.0	1.5	6.5	1.5	5.0	1.5	6.0	ns
tPLZ tPHZ	Output Disable Time $\overline{OE_A}$ to OAn, $\overline{OE_B}$ to $\overline{OBn}$										

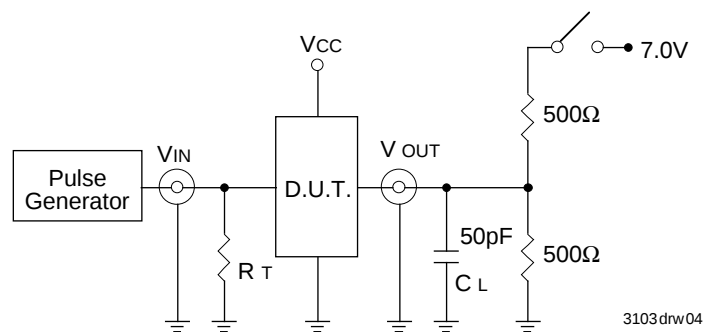
NOTES:

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- See test circuits and waveforms.
- Minimum limits are guaranteed but not tested on Propagation Delays.
- tPLH, tPHL, tsk(t) are production tested. All other parameters guaranteed but not production tested.
- Propagation delay range indicated by Min. and Max. limit is due to Vcc, operating temperature and process parameters. These propagation delay limits do not imply skew.

TEST CIRCUITS AND WAVEFORMS

TEST CIRCUIT FOR ALL OUTPUTS



ENABLE AND DISABLE TIME SWITCH POSITION

Test	Switch
Disable LOW Enable LOW	Closed
Disable HIGH Enable HIGH	Open

DEFINITIONS:

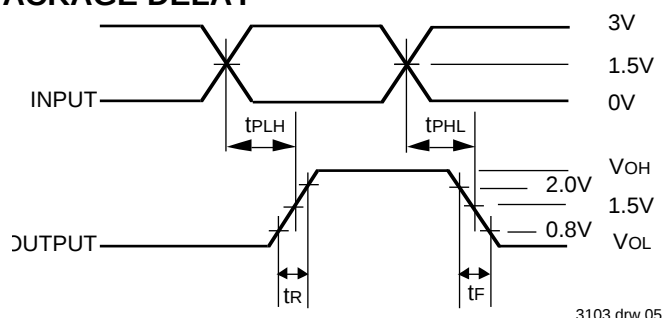
C_L = Load capacitance: includes jig and probe capacitance.

R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

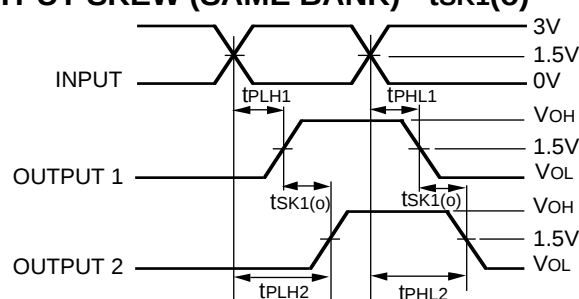
3103 Ink 07

TEST WAVEFORMS

PACKAGE DELAY

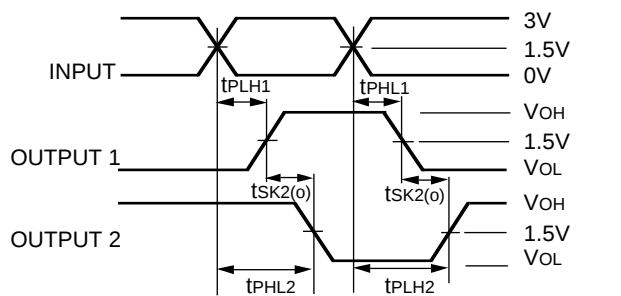


OUTPUT SKEW (SAME BANK) - $t_{SK1(o)}$



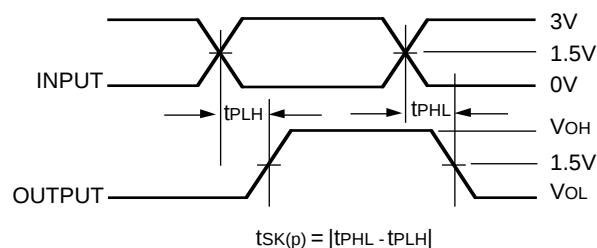
$$t_{SK1(o)} = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

OUTPUT SKEW (ALL BANKS) - $t_{SK2(o)}$



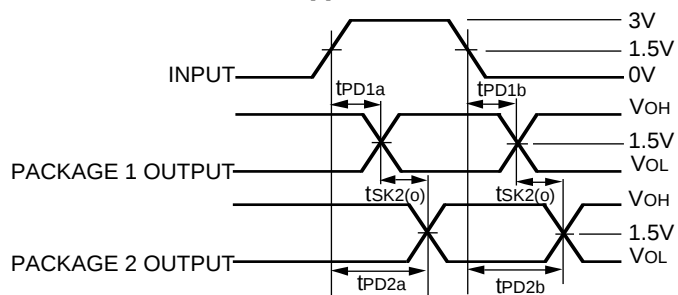
$$t_{SK2(o)} = |t_{PHL2} - t_{PLH1}| \text{ or } |t_{PLH2} - t_{PHL1}|$$

PULSE SKEW - $t_{SK(p)}$



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

PACKAGE SKEW - $t_{SK(t)}$



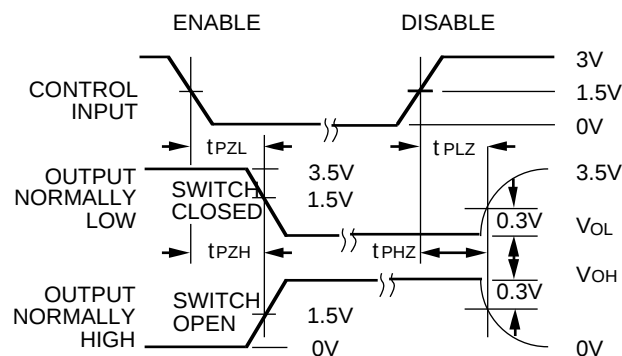
$$t_{SK(t)} = |t_{PD2a} - t_{PD1a}| \text{ or } |t_{PD2b} - t_{PD1b}|$$

Package 1 and Package 2 are same device type and speed grade

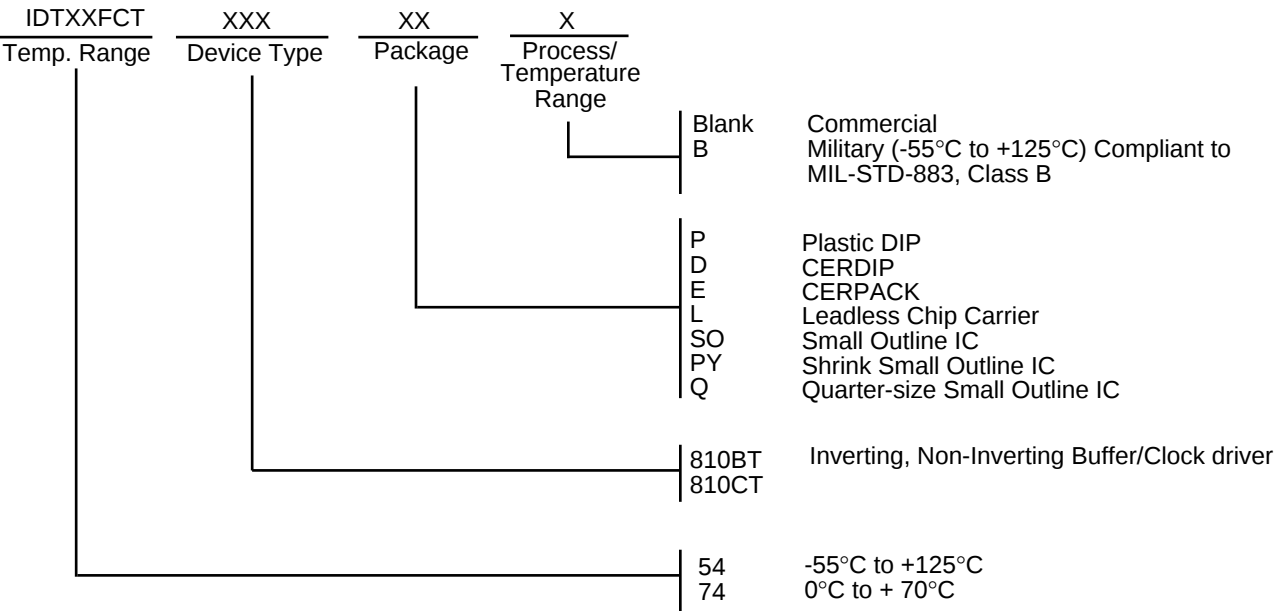
NOTES:

- Diagram shown for input Control Enable-LOW and input Control Disable-HIGH
- Pulse Generator for All Pulses: $f \leq 1.0\text{MHz}$; $t_F \leq 2.5\text{ns}$; $t_R \leq 2.5\text{ns}$

ENABLE AND DISABLE TIMES



ORDERING INFORMATION



3103 drw 13