

# SERIES 15830, SERIES 15930 DTL INTEGRATED CIRCUITS

## DTL SMALL-SCALE INTEGRATION (SSI)

Function	Operating Temperature		Packages*	
	Ranges		Dual-In-	
	-55°C to 125°C	0°C to 75°C	Line	Flat
<b>GATES WITH 6-kΩ PULL-UP RESISTORS</b>				
Expandable Dual 4-Input NAND Gates	SN 15930	SN 15830	J	N U
Quadruple 2-Input NAND Gates	SN 15946	SN 15846	J	N U
Triple 3-Input NAND Gates	SN 15962	SN 15862	J	N U
Dual 5-Input NAND Gates	SN 151900	SN 151800	J	N U
Expandable 8-Input NAND Gates	SN 151902	SN 151802	J	N U
10-Input NAND Gates	SN 151904	SN 151804	J	N U
Quadruple 2-Input AND Gates	SN 151906	SN 151806	J	N U
Quadruple 2-Input OR Gates	SN 151908	SN 151808	J	N U
Quadruple 2-Input NOR Gates	SN 151910	SN 151810	J	N U
Quadruple 2-Input Exclusive-OR Gates	SN 151912	SN 151812	J	N U
<b>GATES WITH 2-kΩ PULL-UP RESISTORS</b>				
Quadruple 2-Input NAND Gates	SN 15949	SN 15849	J	N U
Expandable Dual 4-Input NAND Gates	SN 15961	SN 15861	J	N U
Triple 3-Input NAND Gates	SN 15963	SN 15863	J	N U
Dual 5-Input NAND Gates	SN 151901	SN 151801	J	N U
Expandable 8-Input NAND Gates	SN 151903	SN 151803	J	N U
10-Input NAND Gates	SN 151905	SN 151805	J	N U
Quadruple 2-Input AND Gates	SN 151907	SN 151807	J	N U
Quadruple 2-Input OR Gates	SN 151909	SN 151809	J	N U
Quadruple 2-Input NOR Gates	SN 151911	SN 151811	J	N U
<b>POWER/BUFFER GATES</b>				
Expandable Dual 4-Input NAND Buffer Gates	SN 15932	SN 15832	J	N U
Expandable Dual 4-Input NAND Power Gates	SN 15944	SN 15844	J	N U
Quadruple 2-Input NAND Buffer Gates	SN 15957	SN 15857	J	N U
Quadruple 2-Input NAND Power Gates	SN 15958	SN 15858	J	N U
<b>HEX INVERTERS</b>				
6-kΩ Pull-Up Resistors	SN 15934	SN 15834	J	N U
Expandable (Open-Base) or Translator Inputs	SN 15935	SN 15835	J	N U
6-kΩ Pull-Up Resistors	SN 15936	SN 15836	J	N U
2-kΩ Pull-Up Resistors	SN 15937	SN 15837	J	N U
Open-Collector Outputs	SN 15938	SN 15838	J	N U
<b>EXPANDERS</b>				
Dual 4-Input Expanders	SN 15933	SN 15833	J	N U
<b>FLIP-FLOPS</b>				
Gated J-K/R-S (6-kΩ Pull-Up Resistors)	SN 15931	SN 15831	J	N U
Gated J-K/R-S (6-kΩ Pull-Up Resistors)	SN 15945	SN 15845	J	N U
Gated J-K/R-S (2-kΩ Pull-Up Resistors)	SN 15948	SN 15848	J	N U
Pulse-Triggered Binary (Active Pull-Up)	SN 15950	SN 15850	J	N U
Dual J-K, Individual Clocks and Presets (6-kΩ Pull-Up Resistors)	SN 159093	SN 158093	J	N U
Dual J-K, Individual Clocks and Presets (2-kΩ Pull-Up Resistors)	SN 159094	SN 158094	J	N U
Dual J-K, Common Clocks and Clears (2-kΩ Pull-Up Resistors)	SN 159097	SN 158097	J	N U
Dual J-K, Common Clocks and Clears (6-kΩ Pull-Up Resistors)	SN 159099	SN 158099	J	N U
<b>MONOSTABLE MULTIVIBRATORS</b>				
Gated, Negative-Edge-Triggered	SN 15951	SN 15851	J	N U

\*For outline drawings of all packages, see Section 1.

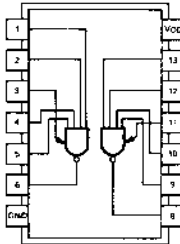
—SEE ORDERING INSTRUCTIONS PAGE 1-1—

**TEXAS INSTRUMENTS**  
INCORPORATED  
POST OFFICE BOX 5012 • DALLAS, TEXAS 75222

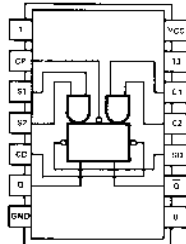
11

# SERIES 15830, SERIES 15930 DTL INTEGRATED CIRCUITS

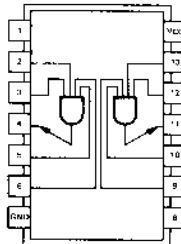
SN15830, SN15832,  
SN15844, SN15861,  
SN15930, SN15932,  
SN15944, SN15961



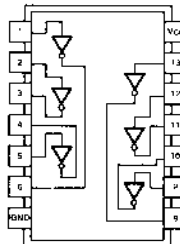
SN15831, SN15845,  
SN15848, SN15931,  
SN15945, SN15948,  
(See Truth Tables 1 and 2)



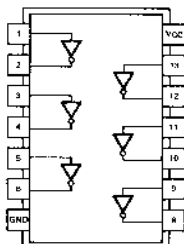
SN15833, SN15933



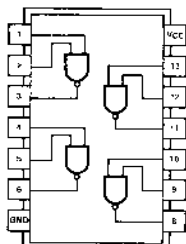
SN15834, SN15934



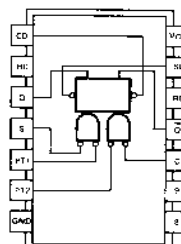
SN15835, SN15836,  
SN15837, SN15838,  
SN15935, SN15936,  
SN15937, SN15938



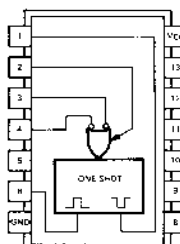
SN15846, SN15849,  
SN15946, SN15949



SN15850, SN15950  
(See Truth Tables 3 and 4)



SN15851, SN15951  
(See Notes A, B, and C)



Each RC is a 1 kΩ resistor to VCC.

TRUTH TABLE 1  
R-S MODE

$t_n$				$t_{n+1}$
S1	S2	C1	C2	Q
L	X	L	X	$Q_n$
L	X	X	L	$Q_n$
X	L	L	X	$Q_n$
X	L	X	L	$Q_n$
L	X	H	H	L
X	L	H	H	L
H	H	L	X	H
H	H	X	L	H
H	H	H	H	Indeterminate

TRUTH TABLE 2  
J-K MODE

$t_n$		$t_{n+1}$
S1	C1	Q
L	L	$Q_n$
L	H	L
H	L	H
H	H	$\bar{Q}_n$

TRUTH TABLE 3  
SYNCHRONOUS

$t_n$				$t_{n+1}$	
S	C	PT1	PT2	Q	$\bar{Q}$
H	X	X	H	$Q_n$	$\bar{Q}_n$
X	H	H	X	$Q_n$	$\bar{Q}_n$
L	H	L	X	H	L
L	X	L	H	H	L
H	L	X	L	L	H
X	L	H	L	L	H
L	L	L	L	Indeterminate	

TRUTH TABLE 4  
ASYNCHRONOUS

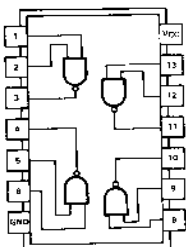
DIRECT INPUT		OUTPUT	
SD	CD	Q	$\bar{Q}$
H	H	$Q_n$	$\bar{Q}_n$
L	H	L	H
H	L	H	L
L	L	H	H

- NOTES:
- $t_n$  = bit time before clock pulse.
  - $t_{n+1}$  = bit time after clock pulse.
  - H = high, L = low, X = irrelevant.
  - For operation in the J-K mode connect S2 to Q and C2 to  $\bar{Q}$ .

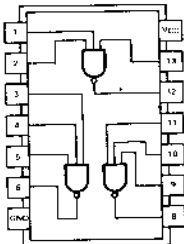
- NOTES:
- External timing resistor may be connected between pins 14 and 10 to control pulse width.
  - External timing capacitor may be connected between pins 10 and 11 to control pulse width.
  - Input sensitivity can be decreased by adding a capacitor from pin 5 to ground.

# SERIES 15830, SERIES 15930 DTL INTEGRATED CIRCUITS

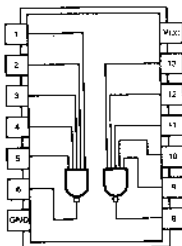
SN15857, SN15858,  
SN15957, SN15958



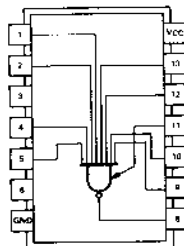
SN15862, SN15863,  
SN15962, SN15963



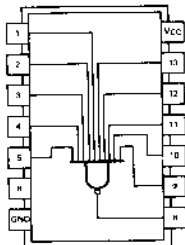
SN151800, SN151801,  
SN151900, SN151901



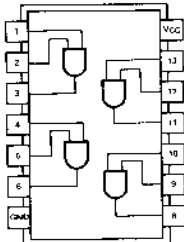
SN151802, SN151803,  
SN151902, SN151903



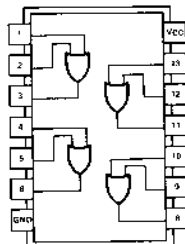
SN151804, SN151805,  
SN151904, SN151905



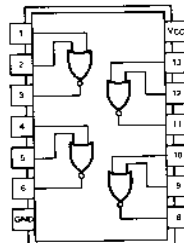
SN151806, SN151807,  
SN151906, SN151907



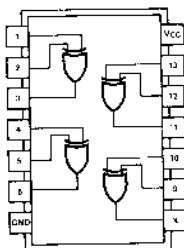
SN151808, SN151809,  
SN151908, SN151909



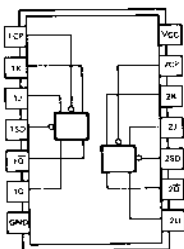
SN151810, SN151811,  
SN151910, SN151911



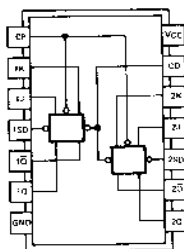
SN151812,  
SN151912



SN158093, SN158094,  
SN159093, SN159094  
(See Truth Table 5)



SN158097, SN158099,  
SN159097, SN159099  
(See Truth Table 5)



TRUTH TABLE 5

	$t_n$	$t_{n+1}$
J	K	Q
L	L	$\bar{Q}_n$
L	H	L
H	L	H
H	H	$\bar{Q}_n$

**SERIES 15830, SERIES 15930  
DTL INTEGRATED CIRCUITS**

**SERIES 15830 GATES, EXPANDER, AND ONE-SHOT**

electrical and switching characteristics (unless otherwise noted,  $V_{CC} = 5\text{ V}$ )

PARAMETER	CONDITIONS	SN15830		SN15832		SN15833		SN15835		SN15837		SN15838		SN15839		SN15840		SN15841		SN15842	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
$V_{OL}$	$I_O = 0\text{L}$ MIN	0	0.45	0	0.45	0	0.45	0	0.45	0	0.45	0	0.45	0	0.45	0	0.45	0	0.45	0	0.45
	75	0	0.5	0	0.5	0	0.5	0	0.5	0	0.5	0	0.5	0	0.5	0	0.5	0	0.5	0	0.5
$V_{OH}$	$I_O = 10\mu\text{A}$ MIN	2.6	2.5	2.6	2.5	2.6	2.5	2.6	2.5	2.6	2.5	2.6	2.5	2.6	2.5	2.6	2.5	2.6	2.5	2.6	2.5
	75	2.3	2.5	2.3	2.5	2.3	2.5	2.3	2.5	2.3	2.5	2.3	2.5	2.3	2.5	2.3	2.5	2.3	2.5	2.3	2.5
$V_{IL}$		0	1.2	0	1.1	0	1.1	0	1.1	0	1.1	0	1.1	0	1.1	0	1.1	0	1.1	0	1.1
	75	0	0.95	0	0.95	0	0.95	0	0.95	0	0.95	0	0.95	0	0.95	0	0.95	0	0.95	0	0.95
$V_{IH}$		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	75	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
$I_{OL}$	$V_O = V_{OL}$ MAX	0	25	0	25	0	25	0	25	0	25	0	25	0	25	0	25	0	25	0	25
	75	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
$I_{OH}$	$V_O = V_{OH}$ MIN	0	-0.12	0	-0.12	0	-0.12	0	-0.12	0	-0.12	0	-0.12	0	-0.12	0	-0.12	0	-0.12	0	-0.12
	75	0.17	-0.12	0.17	-0.12	0.17	-0.12	0.17	-0.12	0.17	-0.12	0.17	-0.12	0.17	-0.12	0.17	-0.12	0.17	-0.12	0.17	-0.12
$I_{OS}$	$V_O = 0\text{ V}$	0	1.3	0	1.3	0	1.3	0	1.3	0	1.3	0	1.3	0	1.3	0	1.3	0	1.3	0	1.3
	75	1.2	1.6	1.2	1.6	1.2	1.6	1.2	1.6	1.2	1.6	1.2	1.6	1.2	1.6	1.2	1.6	1.2	1.6	1.2	1.6
$I_{IL}$	$V_I = V_{OL}$ MAX	0	25	0	25	0	25	0	25	0	25	0	25	0	25	0	25	0	25	0	25
	75	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
$I_{IH}$	$V_I = 4\text{ V}$	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10	0	10
	75	0.75	0.9	0.75	0.9	0.75	0.9	0.75	0.9	0.75	0.9	0.75	0.9	0.75	0.9	0.75	0.9	0.75	0.9	0.75	0.9
$V_f$	$t_P = 2\text{ nA}$	0	25	0	25	0	25	0	25	0	25	0	25	0	25	0	25	0	25	0	25
	75	0.68	0.83	0.68	0.83	0.68	0.83	0.68	0.83	0.68	0.83	0.68	0.83	0.68	0.83	0.68	0.83	0.68	0.83	0.68	0.83
$t_{CCL}$	AVG PER GATE	25	4	25	4	25	4	25	4	25	4	25	4	25	4	25	4	25	4	25	4
$t_{CH}$	AVG PER GATE	25	4	25	4	25	4	25	4	25	4	25	4	25	4	25	4	25	4	25	4
$t_{PLH}$	$V_{CC} = 5\text{ V}$	25	10	25	10	25	10	25	10	25	10	25	10	25	10	25	10	25	10	25	10
	75	25	20	25	20	25	20	25	20	25	20	25	20	25	20	25	20	25	20	25	20

(1) 25°C only.  
 (2) For the SN15838, SN15844, and SN15858,  $V_{OH}$  is measured at 5 mA.  
 (3)  $V_I = 1.35\text{ V}$  at  $T_A$  at 0°C, 1.27 V at  $T_A = 25^\circ\text{C}$ , and 1.25 V at  $T_A = 70^\circ\text{C}$ .  
 (4) For the SN15851, total quiescent values of  $I_{CC}$  are given for  $V_{CC} = 5\text{ V}$  and  $V_{CC} = 8\text{ V}$ .  
 NOTE A: This monostable multivibrator is triggered with a negative-going transition  $\geq 1$  volt having a fall time  $\leq 25$  ns/volt.

**SERIES 15830, SERIES 15930  
DTL INTEGRATED CIRCUITS**

**SERIES 15930 GATES, EXPANDER, AND ONE-SHOT  
electrical and switching characteristics (unless otherwise noted, VCC = 5 V)**

PARAMETER	CONDITIONS	T <sub>A</sub> °C	SN15830		SN15832		SN15833		SN15828		SN15834		SN15844		SN15861		SN151906		SN151907		SN151908		SN151909		SN151910		SN151911		SN151912		UNIT		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
V <sub>OL</sub>	I <sub>O</sub> = I <sub>O1</sub> MIN	-55 to 75	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	V	
			1.2	0.45																													
V <sub>OH</sub>	I <sub>O</sub> = I <sub>O1</sub> MIN	25	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	V	
			3.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	
V <sub>IL</sub>		25	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	V	
			0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
V <sub>M</sub>		25	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	V	
			1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	
I <sub>OL</sub>	V <sub>O</sub> = V <sub>OH</sub> MAX	25	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	mA	
			10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	
I <sub>OH</sub>	V <sub>O</sub> = V <sub>OH</sub> MIN	25	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	mA	
			0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	
I <sub>OS</sub>	V <sub>O</sub> = 0 V	25	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	-1.34	mA	
			-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3	
I <sub>L</sub>	V <sub>I</sub> = 0 V	25	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	mA
			-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	
I <sub>M</sub>	V <sub>I</sub> = 4 V	25	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	μA
			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
V <sub>F</sub>	I <sub>F</sub> = 2 mA	25	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	V	
			0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
V <sub>CC</sub>	AVG PER GATE	25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	mA
			2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	
I <sub>CC1</sub>	V <sub>CC</sub> = 8 V	25	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	mA
			8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
I <sub>PH</sub>		25	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	mA
			25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25

- (1) 25 °C only.
  - (2) For the SN15938, SN15944, and SN15958, V<sub>OH</sub> is measured at 5 mA.
  - (3) V<sub>I</sub> = 0.98 V at T<sub>A</sub> = -55 °C, 0.82 V at T<sub>A</sub> = 25 °C, and 0.65 V at T<sub>A</sub> = 125 °C.
  - (4) For the SN15951, total quiescent values of I<sub>CC</sub> are given for V<sub>CC</sub> = 5 V and V<sub>CC</sub> = 8 V.
- NOTE A: This monostable multivibrator is triggered with a negative-going transition ≥ 1 volt having a fall time ≤ 25 ns/volt.

**SERIES 15830, SERIES 15930  
DTL INTEGRATED CIRCUITS**

**SERIES 15830 DTL FLIP-FLOPS**

electrical and switching characteristics (unless otherwise noted,  $V_{CC} = 5$ )

PARAMETER	CONDITIONS	T <sub>A</sub> (°C)	SN15831		SN15845		SN15848		SN15850		SN158093		SN158094		SN158097		SN158099		UNIT		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		MIN	MAX
V <sub>OL</sub>	I <sub>O</sub> = I <sub>OL</sub> MIN	0 and 25	0.45	0.5	0.45	0.5	0.45	0.5	0.45	0.5	0.45	0.5	0.45	0.5	0.45	0.5	0.45	0.5	0.45	0.5	V
		75	2.6	2.5	2.6	2.5	3.8	3.7	3.8	2.6	2.5	3.8	3.7	3.8	2.6	2.5	3.8	3.7	3.8	2.6	2.5
V <sub>OH</sub>	I <sub>O</sub> = I <sub>OH</sub> MIN	0	1.2	1.1	1.2	1.1	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	V
		25 and 75	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
V <sub>IH</sub>		0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	V
		25 and 75	1.9	1.8	1.9	1.8	1.9	1.8	1.9	1.9	1.8	1.9	1.8	1.9	1.9	1.8	1.9	1.8	1.9	1.9	1.8
I <sub>OL</sub>	V <sub>O</sub> = V <sub>OL</sub> MAX	0 and 25	10.5	10.2	16.8	15.4	15.4	14.6	12	11.4	16.8	15.4	15.4	14.6	16.8	15.4	16.8	14.6	16.8	15.4	mA
		75	10.2	0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12
I <sub>OS</sub>	V <sub>O</sub> = 0 V	0			-0.59	-1.41	-1.77	4.2	13.7	-29											mA
		25 and 75			-0.59	-1.41	1.77	-4.2	-13.7	-29											
I <sub>IL</sub>	V <sub>I</sub> V <sub>OL</sub> MAX	0 and 25	-1.06	1	0.95	-0.9	-0.9	-0.9	-2	2.1	-0.95	-0.95	-0.95	-0.95	-0.95	-0.95	-0.95	-0.95	-0.95	-0.95	mA
		75	-2.8	-2.67	-2.8	-2.67	-2.8	-2.67	-2.8	-2.67	-2.8	-2.67	-2.8	-2.67	-2.8	-2.67	-2.8	-2.67	-2.8	-2.67	-2.8
I <sub>IH</sub>	V <sub>I</sub> 4 V	0 and 25	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	μA
		75	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
I <sub>CC</sub>	V <sub>CC</sub> = 8 V	0 and 25	30	30	20	20	20	20	30	30	30	30	30	30	30	30	30	30	30	30	mA
		75	40	40	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
t <sub>PHL</sub>	FROM CLOCK TO OUTPUT	0 and 25	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	ns
		75	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
t <sub>PLH</sub>	FROM CLOCK TO OUTPUT	0 and 25	14	14	16	17.5	17.5	17.5	9.3	9.3	32	35	35	35	35	35	35	35	35	35	ns
		25	18	18	18.5	22.5	22.5	22.5	19.6	19.6	37	45	45	45	45	45	45	45	45	45	45
t <sub>PLH</sub>	FROM CLOCK TO OUTPUT	0 and 25	35	35	15	65	65	65	5	32	15	75	75	75	75	75	75	75	75	75	ns
		25	35	35	25	75	75	75	5	25	25	75	75	75	75	75	75	75	75	75	75

(1) Double the limit for the common clear input.

**SERIES 15930, SERIES 15930  
DTL INTEGRATED CIRCUITS**

**SERIES 15930 DTL FLIP-FLOPS**

electrical and switching characteristics (unless otherwise noted, VCC = 5)

PARAMETER	CONDITIONS	TA (°C)	SN15931 MIN	SN15945 MIN	SN15948 MIN	SN15950 MIN	SN15993 MIN	SN15994 MIN	SN15997 MIN	SN15999 MIN	UNIT
VOL	IO = IOH MIN	-55 and 25	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	V
		125	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	
VOH	IO = IOH MIN	55	2.5	2.5	3.8	3.8	2.5	3.8	3.8	2.5	V
		25	2.6	2.6	3.8	3.8	2.6	3.8	3.8	2.6	
VIL		125	2.5	2.5	3.7	3.7	2.5	3.7	3.7	2.5	
		-55	1.1	1.4	1.4	1.4	1.4	1.4	1.4	1.4	V
VIH		25	0.95	1.1	1.1	1.1	1.1	1.1	1.1	1.1	V
		125	0.75	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
IOL	VO = VOL MAX	-55	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	mA
		25	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	
IOH	VO = VOH MIN	125	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	mA
		55	10	14.6	13	11.4	14.6	13	13	14.6	
IOS	VO = VOH MIN	25	10.6	15.2	13.6	12	15.2	13.6	13.6	15.2	mA
		125	9.5	13.8	12.3	10.8	13.8	12.3	12.3	13.8	
IIL	V = 0 V	55	0.12	-0.17	-0.17	-0.17	-0.12	-0.12	-0.12	-0.12	mA
		25	0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	
IOL	VO = VOH MIN	125	0.12	-0.17	-0.17	-0.17	-0.12	-0.12	-0.12	-0.12	mA
		55 and 25	-0.7	-1.33	-2.1	-3.96	-0.7	-2.4	-0.7	-2.4	mA
IIL	V = 0 V	125	-0.67	-1.3	-1.86	-3.54	-0.67	-1.3	-1.07	-2.4	mA
		55 and 25	-1.07	-1.07	-1.07	-1.07	-1.07	-1.07	-1.07	-1.07	mA
IIL	V = 0 V	125	1	1	1	1	1	1	1	1	mA
		55 and 25	3.4	-3.7	-2.96	-2.2	3.2	3.2	3.2	3.2	mA
IIL	V = 0 V	125	-3	-2.8	-2.2	-2.2	3	3	3	3	mA
		55	-1.7	-2.4	-2.4	-2.4	3.2	3.2	3.2	3.2	mA
IIL	V = 0 V	25	-1.7	-2.4	-2.4	-2.4	3.2	3.2	3.2	3.2	mA
		125	-1.1	2.1	2.1	1.82	-3.0	-3.0	-3.0	-3.0	mA
IIL	V = 0 V	-55 and 25	2	2	2	2	2	2	2	2	µA
		125	5	5	5	5	5	5	5	5	
IIL	V = 4 V	55 and 25	20	10	10	10	10	10	10	10	µA
		125	30	20	20	20	20	20	20	20	
IIL	V = 4 V	-55 and 25	2	2	2	2	2	2	2	2	µA
		125	5	5	5	5	5	5	5	5	
IIL	V = 4 V	25	11	14	16.2	8.7	28	37	37	28	mA
		125	14.5	17	21.6	18.4	34	42	42	34	
IIL	FROM CLOCK TO OUTPUT	25	35	75	15	65	5	32	15	75	ns
		125	35	75	25	75	25	75	25	75	
IIL	FROM CLOCK TO OUTPUT	25	35	75	25	75	25	75	25	75	ns
		125	35	75	25	75	25	75	25	75	

(1) 25°C only.  
(2) Double the limit shown for common clear inputs.