3.3V CMOS DUAL POSITIVE EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH CLEAR AND PRESET

IDT74ALVC74
ADVANCE INFORMATION

FEATURES:

- 0.5 MICRON CMOS Technology
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- 1.27mm pitch SOIC, 0.65mm pitch SSOP and 0.65mm pitch TSSOP packages
- Extended commercial range of – 40°C to +85°C
- V_{CC} = 3.3V ± 0.3V, Normal Range
- V_{CC} = 2.7V to 3.6V, Extended Range
- V_{CC} = 2.5V ± 0.2V
- CMOS power levels (0.4µW typ. static)
- Rail-to-Rail output swing for increased noise margin

Drive Features for ALVC74:

- High Output Drivers: ±24mA
- Suitable for heavy loads

DESCRIPTION:

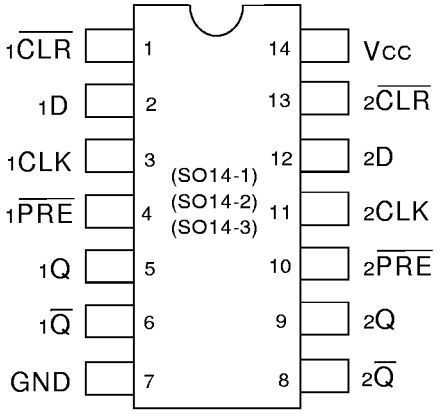
This dual positive-edge-triggered D-type flip-flop is built using advanced dual metal CMOS technology. A low level at the preset ($\overline{PRE}$) or clear ($\overline{CLR}$) inputs sets or resets the outputs, regardless of the levels of the other inputs. When $\overline{PRE}$ and $\overline{CLR}$ are inactive (high), data at the data (D) input meeting the setup time requirements is transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of the clock pulse. Following the hold-time interval, data at the D input may be changed without affecting the levels at the outputs.

The ALVC74 has been designed with a ±24mA output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.

APPLICATIONS:

- 3.3V High Speed Systems
- 3.3V and lower voltage computing systems

PIN CONFIGURATION

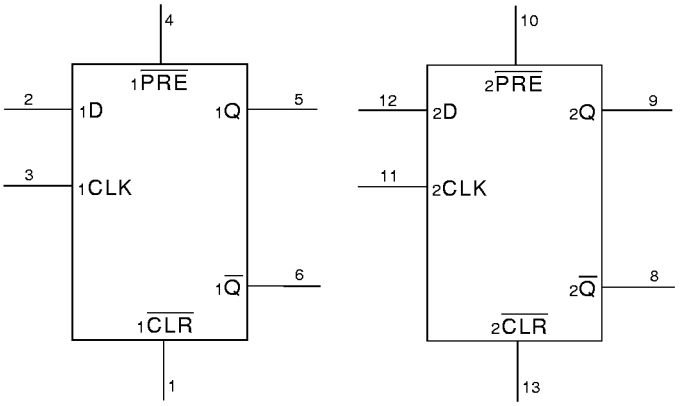


SOIC/SSOP/TSSOP
TOP VIEW

PIN DESCRIPTION

Pin Names	Description
xCLK	Clock Inputs
$x\overline{CLR}$	Clear Inputs
$x\overline{PRE}$	Preset Inputs
xD	Data Inputs
xQ, $x\overline{Q}$	Data Outputs

LOGIC SYMBOLS



EXTENDED COMMERCIAL TEMPERATURE RANGE **MARCH 1999**

FUNCTION TABLE (1)

Inputs				Outputs	
$\overline{xPRE}$	$\overline{xCLR}$	xCLK	xD	xQ	$x\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H(2)	H(2)
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Qo(3)	$\overline{Q}o$(4)

NOTES:
1. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care
   Z = High-Impedance
   ↑ = LOW-to-HIGH Transition
2. This configuration is unstable; that is, it does not persist when $\overline{PRE}$ or $\overline{CLR}$ returns to its inactive (HIGH) level.
3. Qo = Level of Q before the indicated steady-state input conditions were established.
4. $\overline{Q}o$ = Complement of Qo or level of $\overline{Q}o$ before the indicated steady-state input conditions were established.

ABSOLUTE MAXIMUM RATING(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 V_{CC} + 0.5	V
T_{STG}	Storage Temperature	– 65 to + 150	°C
I_{OUT}	DC Output Current	– 50 to + 50	mA
I_{IK}	Continuous Clamp Current, V_I < 0 or V_I > V_{CC}	± 50	mA
I_{OK}	Continuous Clamp Current, V_O < 0	– 50	mA
I_{CC} I_{SS}	Continuous Current through each V_{CC} or GND	±100	mA

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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. All terminals except V_{CC}.

CAPACITANCE (TA = +25°C, f = 1.0MHz)

Symbol	Parameter(1)	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	5	7	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	7	9	pF
$C_{I/O}$	I/O Port Capacitance	V_{IN} = 0V	7	9	pF

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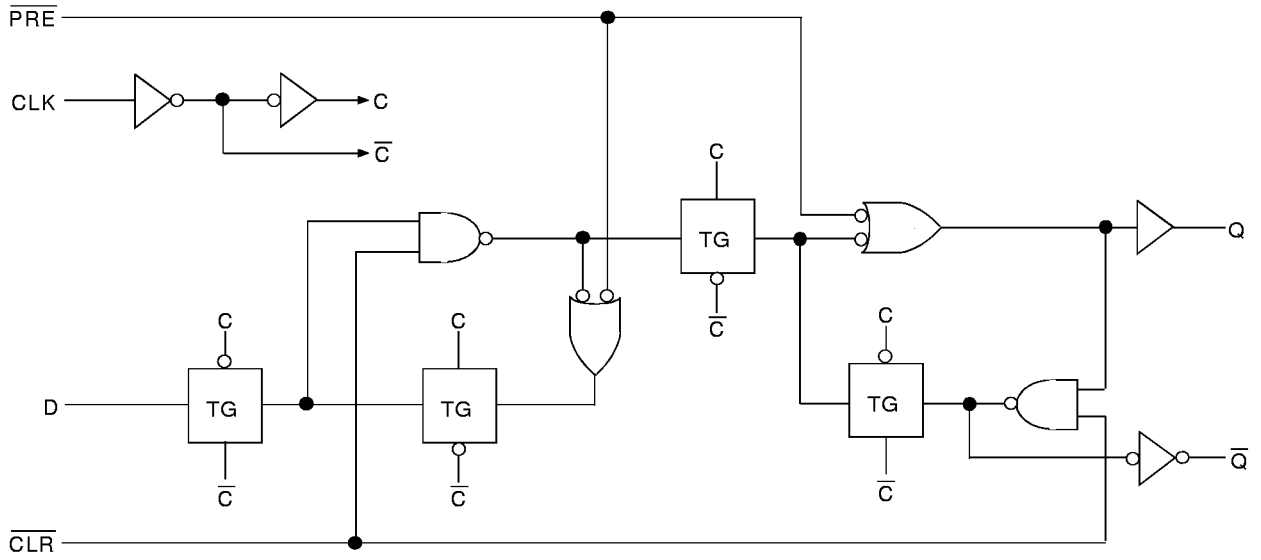
NOTE:
1. As applicable to the device type.

FUNCTIONAL BLOCK DIAGRAM



DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Operating Condition: T_A = –40°C to +85°C

Symbol	Parameter	Test Conditions		Min.	Typ.(1)	Max.	Unit
V_{IH}	Input HIGH Voltage Level	V_{CC} = 2.3V to 2.7V		1.7	—	—	V
		V_{CC} = 2.7V to 3.6V		2	—	—	
V_{IL}	Input LOW Voltage Level	V_{CC} = 2.3V to 2.7V		—	—	0.7	V
		V_{CC} = 2.7V to 3.6V		—	—	0.8	
I_{IH}	Input HIGH Current	V_{CC} = 3.6V	V_I = V_{CC}	—	—	± 5	µA
I_{IL}	Input LOW Current	V_{CC} = 3.6V	V_I = GND	—	—	± 5	
I_{OZH}	High Impedance Output Current	V_{CC} = 3.6V	V_O = V_{CC}	—	—	± 10	µA
I_{OZL}	(3-State Output pins)		V_O = GND	—	—	± 10	µA
V_{IK}	Clamp Diode Voltage	V_{CC} = 2.3V, I_{IN} = – 18mA		—	– 0.7	– 1.2	V
V_H	Input Hysteresis	V_{CC} = 3.3V		—	100	—	mV
I_{CCL} I_{CCH} I_{CCZ}	Quiescent Power Supply Current	V_{CC} = 3.6V V_{IN} = GND or V_{CC}		—	0.1	10	µA
ΔI_{CC}	Quiescent Power Supply Current Variation	One input at V_{CC} – 0.6V, other inputs at V_{CC} or GND		—	—	750	µA

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NOTE:
1. Typical values are at V_{CC} = 3.3V, +25°C ambient.

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions(1)		Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC} = 2.3V to 3.6V	I_{OH} = – 0.1mA	V_{CC} – 0.2	—	V
		V_{CC} = 2.3V	I_{OH} = – 6mA	2	—	
		V_{CC} = 2.3V	I_{OH} = – 12mA	1.7	—	
		V_{CC} = 2.7V		2.2	—	
		V_{CC} = 3.0V		2.4	—	
		V_{CC} = 3.0V	I_{OH} = – 24mA	2	—	
V_{OL}	Output LOW Voltage	V_{CC} = 2.3V to 3.6V	I_{OL} = 0.1mA	—	0.2	V
		V_{CC} = 2.3V	I_{OL} = 6mA	—	0.4	
			I_{OL} = 12mA	—	0.7	
		V_{CC} = 2.7V	I_{OL} = 12mA	—	0.4	
		V_{CC} = 3.0V	I_{OL} = 24mA	—	0.55	

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NOTE:
1. V_{IH} and V_{IL} must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate V_{CC} range. T_A = – 40°C to + 85°C.

OPERATING CHARACTERISTICS, T_A = 25°C

Symbol	Parameter	Test Conditions	Vcc = 2.5V ± 0.2V Typical	Vcc = 3.3V ± 0.3V Typical	Unit
C_{PD}	Power Dissipation Capacitance per flip-flop	C_L = 0pF, f = 10Mhz			pF

SWITCHING CHARACTERISTICS (1)

Symbol	Parameter	Vcc = 2.5V ± 0.2V Min.	Vcc = 2.5V ± 0.2V Max.	Vcc = 2.7V Min.	Vcc = 2.7V Max.	Vcc = 3.3V ± 0.3V Min.	Vcc = 3.3V ± 0.3V Max.	Unit
f_{MAX}								MHz
t_{PLH} t_{PHL}	Propagation Delay xCLK to xQ or $x\overline{Q}$		6		5		3.8	ns
t_{PLH} t_{PHL}	Propagation Delay $x\overline{PRE}$ or $x\overline{CLR}$ to xQ or $x\overline{Q}$		6.2		5.2		4	ns
t_W	Pulse Duration, $x\overline{PRE}$ or $x\overline{CLR}$ LOW	3.3		3.3		3.3		ns
t_W	Pulse Duration, xCLK HIGH or LOW	3.3		3.3		3.3		ns
t_{SU}	Setup Time, data before xCLK↑	3		3		3		ns
t_{SU}	Setup Time, $x\overline{PRE}$ or $x\overline{CLR}$ inactive	2		2		2		ns
t_H	Hold Time, data after xCLK↑	1		1		0		ns

NOTE:
1. See test circuits and waveforms. T_A = – 40°C to + 85°C.

TEST CIRCUITS AND WAVEFORMS:

TEST CONDITIONS

Symbol	$V_{CC}^{(1)}$= 3.3V ± 0.3V	$V_{CC}^{(1)}$ = 2.7V	$V_{CC}^{(2)}$= 2.5V ± 0.2V	Unit
V_{LOAD}	6	6	2 x Vcc	V
V_{IH}	2.7	2.7	Vcc	V
V_T	1.5	1.5	Vcc / 2	V
V_{LZ}	300	300	150	mV
V_{HZ}	300	300	150	mV
C_L	50	50	30	pF

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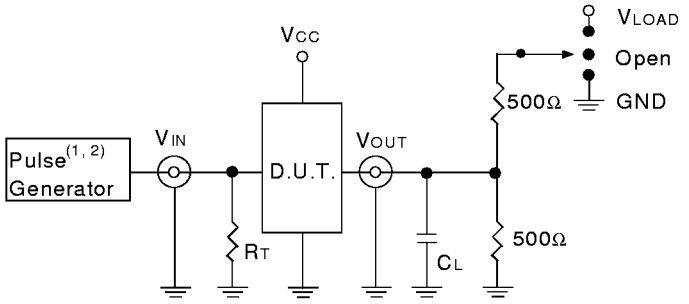
TEST CIRCUITS FOR ALL OUTPUTS



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DEFINITIONS:

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

NOTES:

1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2ns; t_R ≤ 2ns.

SWITCH POSITION

Test	Switch
Open Drain Disable Low Enable Low	V_{LOAD}
Disable High Enable High	GND
All Other tests	Open

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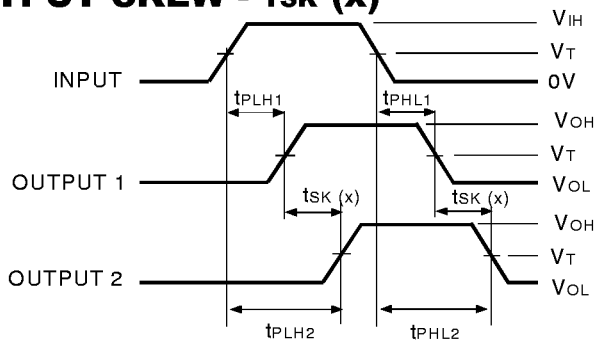
OUTPUT SKEW - t_{SK} (x)



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

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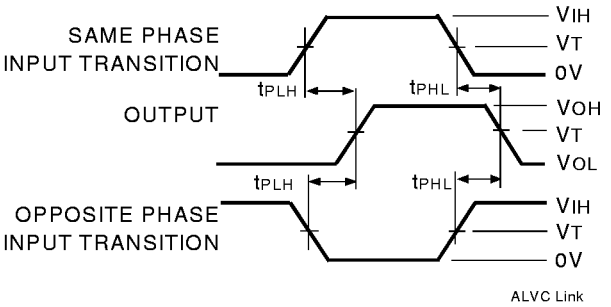
NOTES:

1. For t_{SK}(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For t_{SK}(b) OUTPUT1 and OUTPUT2 are in the same bank.

PROPAGATION DELAY



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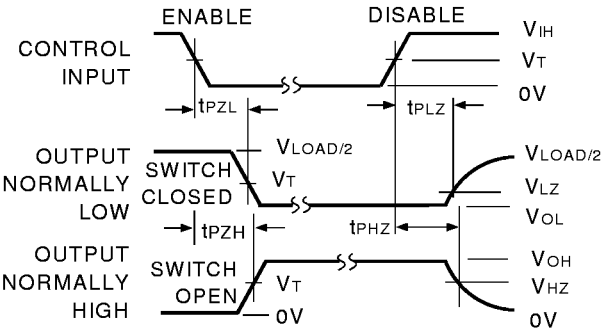
ENABLE AND DISABLE TIMES



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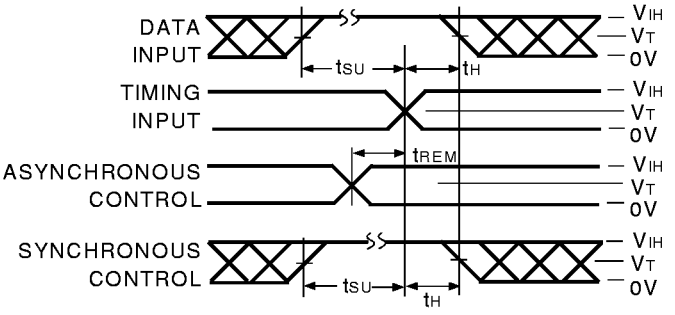
NOTE:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

SET-UP, HOLD, AND RELEASE TIMES



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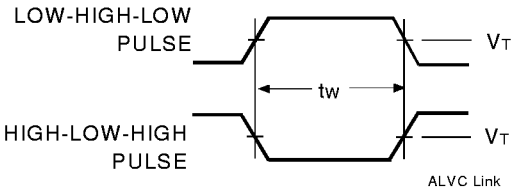
PULSE WIDTH



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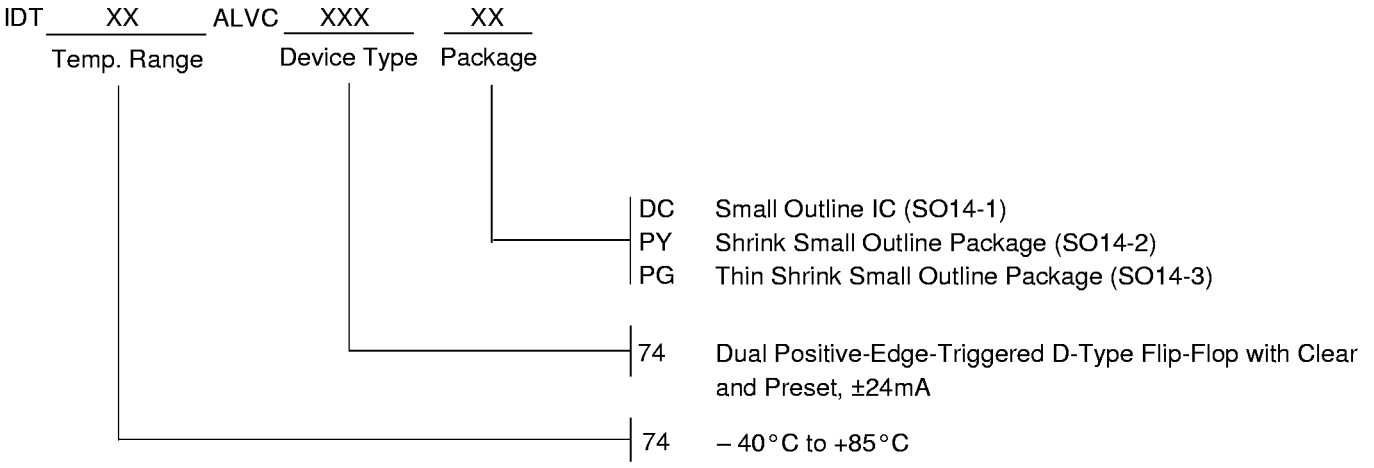
ORDERING INFORMATION



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