DS1671/DS3671 Bootstrapped Two Phase MOS Clock Driver

General Description

The DS1671/DS3671 is a high speed dual MOS clock driver and interface circuit. Unique circuit design provides both very high speed operation and the ability to drive large capacitive loads. The device accepts standard TTL outputs and converts them to MOS logic levels. It may be driven from standard 54/74 and 54S/74S series gates and flip-flops or from drivers such as the DS8830 or DM7440. The circuit can be used in both P-channel and N-channel MOS memory system drive applications.

The DS1671/DS3671 is intended to fulfill a wide variety of MOS interface requirements. As a MOS clock driver for long silicon gate shift registers, a single device can drive over 10k bits at 5 MHz. Six devices provide input address and precharge drive for an 8k by 16-bit 1103 RAM memory system.

Each driver uses output bootstrapping to provide a higher voltage to the output stage, thus eliminating the need for an additional V_{DD} supply. The bootstrapping function is accomplished by connecting a small value capacitor (typically 200 pF) from each output to each drivers bootstrap node.

Features

- Fast rise and fall times—20 ns with 1000 pF load
- High output swing—20V
- High output current drive—±1.5A
- TTL compatible inputs
- High rep rate—5 to 10 MHz depending on power dissipation
- Low power consumption in MOS "0" state—2 mW
- Swings to 0.4V of GND for RAM address drive

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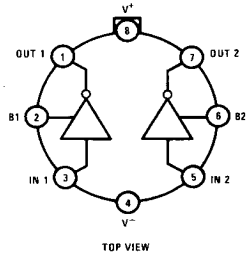
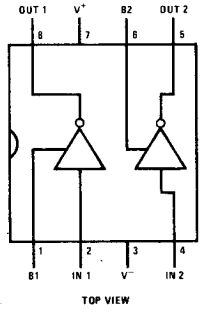
Connection Diagrams

Metal Can Package



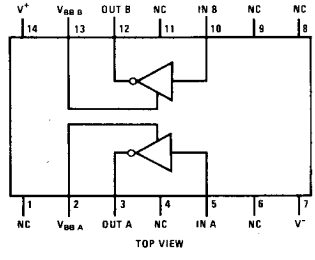
Order Number DS1671H or DS3671H
See NS Package H08C

Dual-In-Line Package



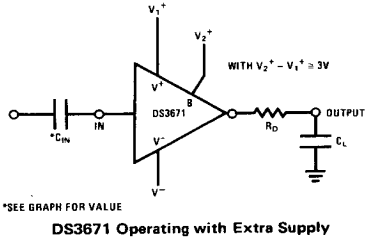
Order Number DS1671J-8, DS3671J-8 or DS3671N
See NS Package J08A or N08A

Dual-In-Line Package

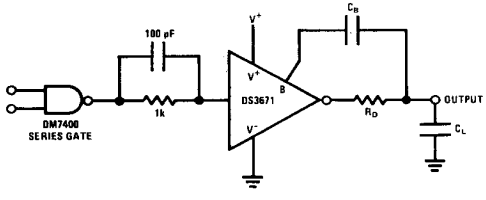


Order Number DS1671J or DS3671J
See NS Package J14A

Typical Applications



DS3671 Operating with Extra Supply to Inhance Output Voltage Level



Bootstrap Clock Driver Driven from a TTL Gate

Absolute Maximum Ratings (Note 1)

$V^+ - V^-$ Differential	22V
$V_B - V^-$ Differential	40V
$V_B - V^+$ Differential	20V
Input Voltage ($V_{IN} - V^-$)	5.5V
Input Current	100 mA
Peak Output Current	1.5A
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	300°C
Maximum Power Dissipation* at 25°C	
Cavity Package (8-Pin)	1150 mW
Cavity Package (14-Pin)	1380 mW
Molded Package	1040 mW
Metal Can (TO-5) Package	660 mW

Operating Conditions

	MIN	MAX	UNITS
Supply Voltage			
$V^+ - V^-$ Differential		20	V
$V_B - V^-$ Differential		40	V
$V_B - V^+$ Differential		20	V
Operating Temperature Range			
DS3671	0	+70	°C
DS1671	−55	+125	°C

*Derate 8-pin cavity package 7.7 mW/°C above 25°C; derate 14-pin cavity package 9.3 mW/°C above 25°C; derate molded package 8.4 mW/°C above 25°C; derate metal can (TO-5) package 4.4 mW/°C above 25°C.

Electrical Characteristics (Notes 2 and 3)

PARAMETER		CONDITIONS		MIN	TYP	MAX	UNITS
V_{IH}	Logical "1" Input Voltage	$V^- = 0V$		2.0	1.5		V
I_{IH}	Logical "1" Input Current	$V_{IN} - V^- = 2.4V$			10	15	mA
V_{IL}	Logical "0" Input Voltage	$V^- = 0V$			0.6	0.4	V
I_{IL}	Logical "0" Input Current	$V_{IN} - V^- = 0V$			−3	−10	μA
V_{OH}	Logical "1" Output Voltage	$V_B \geq V^+ + 1.0V$, $V_{IN} - V^- \equiv 0.4V$, $I_O = 0$ mA	DS3671	V^+−1.0	V^+−0.75		V
			DS1671	V^+−1.2	V^+−0.75		V
V_{OL}	Logical "0" Output Voltage	$V_{IN} - V^- = 2.4V$, $I_O = 0$ mA			V^-+0.6	V^-+1.0	V
R_B	Bootstrap Control Resistor			1.1	2.0	3.3	kΩ
$I_{CC(ON)}$	Supply Current One Side "ON"	$V^+ - V^- = 20V$, $V_{IN} - V^- = 2.4V$, $V_B = V^+$			30	40	mA
$I_{CC(OFF)}$	Supply Current "OFF"	$V^+ - V^- = 20V$, $V_{IN} - V^- = 0V$	DS3671		10	100	μA
			DS1671		50	500	μA

Switching Characteristics $T_A = 25°C$, $V^+ = 20V$, $V^- = 0V$

PARAMETER		CONDITIONS		MIN	TYP	MAX	UNITS
t_{pd0}	Propagation Delay to a Logical "0"	$R_D = 10\Omega$, $C_L = 1000$ pF			7.5	15	ns
t_{pd1}	Propagation Delay to a Logical "1"	$R_D = 10\Omega$, $C_L = 1000$ pF			12	15	ns
t_r	Rise Time	$R_D = 10\Omega$	$C_L = 500$ pF		25	35	ns
			$C_L = 1000$ pF		31	40	ns
t_f	Fall Time	$R_D = 10\Omega$	$C_L = 500$ pF		30	40	ns
			$C_L = 1000$ pF		38	50	ns

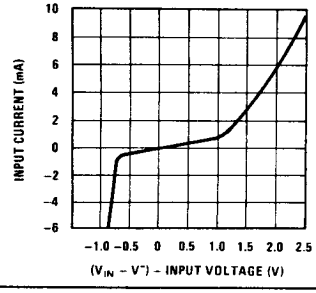
Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: Unless otherwise specified min/max limits apply across the −55°C to +125°C temperature range for the DS1671 and across the 0°C to +70°C range for the DS3671. All typicals at 25°C.

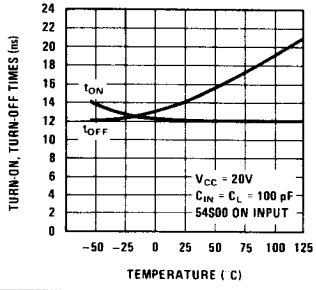
Note 3: All currents into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

Typical Performance Characteristics

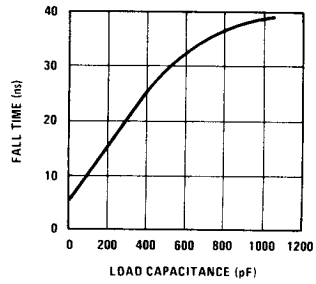
Input Current vs Input Voltage



Turn-On and Turn-Off Time vs Temperature

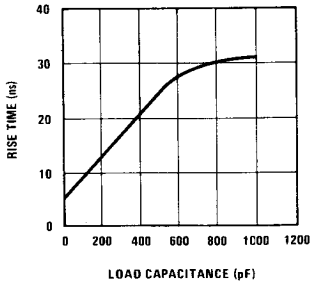


Fall Time vs Load Capacitance

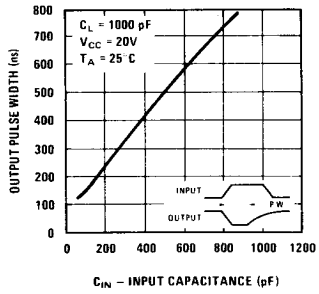


Typical Performance Characteristics (Continued)

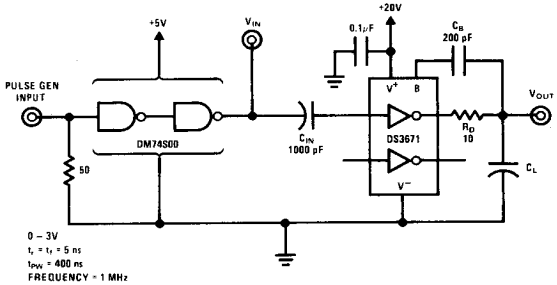
Rise Time vs Load Capacitance

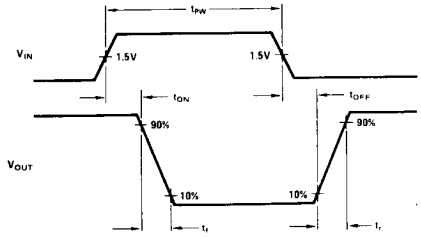


Output Pulse Width When Controlled Only by Input Coupling Capacitor

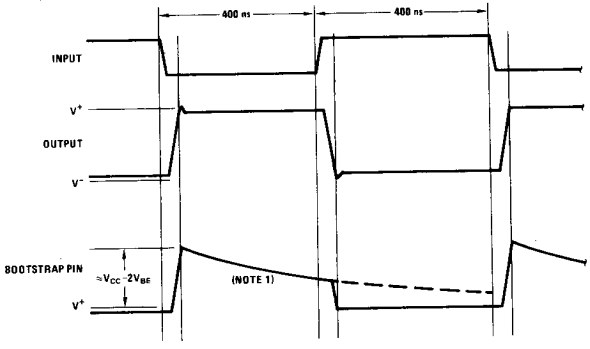


AC Test Circuit and Switching Time Waveforms





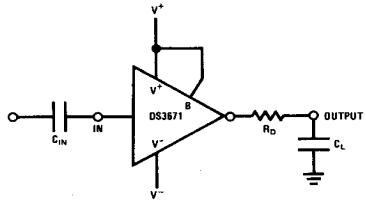
Node Voltage Waveforms



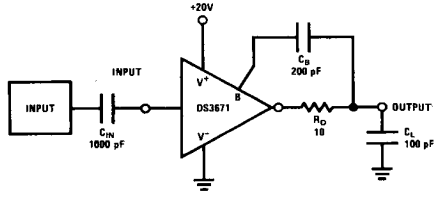
Note 1: The fall time has an exponential decay with the following time constant: $t_B = C_B R_B$. The range of values for R_B (resistor tolerance, and temperature coefficient included) can be found in the table of electrical characteristics.

Note 2: The high current transient (as high as 1.5A) through the resistance of the external interconnecting V^- lead during the output transition from the high state to the low state can appear as negative feedback to the input. If the external interconnecting lead from the driving circuit to V^- is electrically long, or has significant DC resistance, it can subtract from the switching response.

Typical Applications (Continued)



DS3671 Connected as DS0026 with Equivalent Characteristics



Typical Bootstrap

Schematic Diagram (One Driver)