National Semiconductor

DS1642/DS3642, DS1672/DS3672 Dual Bootstrapped TTL to MOS Clock Drivers

General Description

The DS1672 is a dual bipolar-to-MOS clock driver designed to provide high output current and voltage capabilities necessary for driving high capacitance (up to 500 pF) MOS memory systems. The circuit needs only one power supply, (12V typical). This feature greatly reduces high stand-by power levels and at the same time simplifies system deisgn.

The circuit also features output bootstrapping, eliminating the need for an additional supply to provide a higher voltage to the output stage. The function is accomplished by connecting a small value capacitor (typically 200 pF) from the output to the bootstrap pin on each driver.

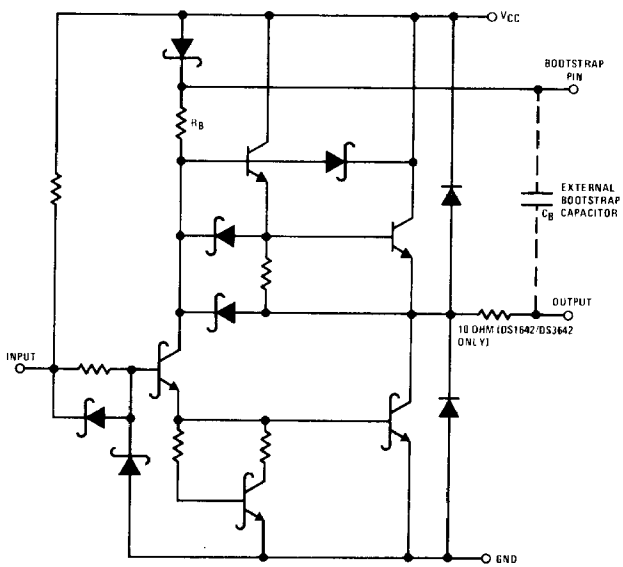
The circuit has Schottky-clamped transistor logic for minimum propagation delay. Typical stand-by power (output low) is 48 mW per driver. A fail-safe condition is provided in the circuit, so if the input is opened the output assumes the logic "0" state.

The DS1642/DS3642 has a 10 Ω resistor in series with each output to dampen transients caused by the fast-switching output. The DS1672/DS3672 has a direct low impedance output for use with or without an external resistor.

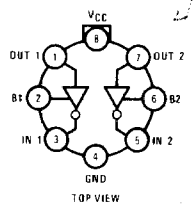
Features

- High output voltage capability 13.2V
- TTL/DTL compatible inputs
- High speed operation
- Bootstrapping eliminates extra supplies—reduces power
- Low stand-by power 48 mW/driver
- Built-in 10 Ω damping resistor (DS1642/DS3642)

Schematic and Connection Diagrams

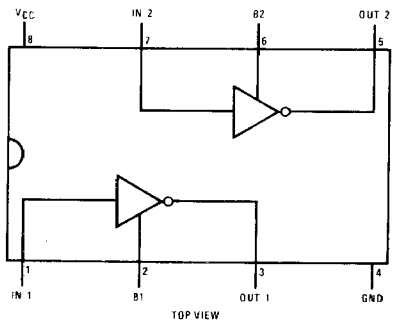


Metal Can Package



Order Number DS1642H, DS1672H, DS3642H or DS3672H
See NS Package H08C

Dual-In-Line Package



Order Number DS1642J-8, DS1672J-8, DS3642J-8, DS3672J-8, DS3642N-8 or DS3672N-8
See NS Package J08A or N08A

Absolute Maximum Ratings (Note 1)

Supply Voltage	15V
Bootstrap–V_{CC} Differential	15V
Bootstrap Pin Voltage	30V
Input Voltage	5.5V
Input Current	10 mA
Output Voltage	−1.0V to +15V
Storage Temperature Range	−65°C
Power Dissipation*	
Cavity Package	1160 mW
Molded Package	890 mW
Metal Can	525 mW
Lead Temperature (Soldering, 10 seconds)	300°C

*Derate cavity package at 80°C/W above 70°C; derate molded package at 90°C/W above 70°C; derate metal can package at 200°C/W above 70°C.

Operating Conditions

	MIN	MAX	UNITS
Supply Voltage (V_{CC})			
DS1642, DS1672	10.8	13.2	V
DS3642, DS3672	11.4	12.6	V
Bootstrap–V_{CC} Differential Voltage (V_B–V_{CC})			
DS1642, DS1672	10.8	13.2	V
DS3642, DS3672	11.4	12.6	V
Temperature (T_A)			
DS1642, DS1672	−55	+125	°C
DS3642, DS3672	0	+70	°C

DC Electrical Characteristics (Notes 2 and 3)

DS1642, DS1672 V_{CC} = 12V ±10%, −55°C ≤ T_A ≤ +125°C, unless otherwise noted.

DS3642, DS3672 V_{CC} = 12V ±5%, 0°C ≤ T_A ≤ +70°C, unless otherwise noted.

PARAMETER		CONDITIONS		MIN	TYP	MAX	UNITS
I_{1T}	Logical "1" Input Current			200	0		μA
V_{IL}	Logical "0" Input Voltage					0.8	V
I_{IH}	Logical "1" Input Current (Note 5)	V_{IN} = 2.4V			0.9	1.5	mA
		V_{IN} = 5.5V			4	5.5	mA
I_{IL}	Logical "0" Input Current	V_{IN} = 0V			−240	−400	μA
V_{CD}	Input Clamp Voltage	I_{IN} = −5 mA			−0.9	−1.5	V
V_{OH}	Logical "1" Output Voltage	$V_B \geq V_{CC}$ + 2V, I_{OUT} = −400 μA			V_{CC}−0.5	V_{CC}−0.8	V
V_{OL}	Logical "0" Output Voltage	I_{OUT} = 5 mA, Bootstrap Pin (V_B) Open, (Note 6)			0.3	0.5	V
R_B	Bootstrap Resistor				3.0		kΩ
$I_{CC(1)}$	Supply Current	V_{IN} = 0V, (Both Drivers "OFF"), Outputs Open	Bootstrap Pin (V_B) Open		0.5	2.0	mA
			V_B = V_{CC} + 7V		−4.2	−6.0	mA
$I_{B(1)}$	Bootstrap Current	(Both Drivers), V_{IN} = 0V, V_B = V_{CC} + 7V			4.2	6.0	mA
$I_{CC(0)}$	Supply Current	V_{IN} = 2.4V, Bootstrap Pin (V_B) Open	(Both Drivers "ON") Outputs Open		8.0	12	mA

Switching Characteristics (Note 4) (V_{CC} = 12V, T_A = 25°C) *(Figures 1 and 2)*

PARAMETER		CONDITIONS		MIN	TYP	MAX	UNITS
t_{S+-}	Storage Delay Negative Edge	R_D = 10 Ω	C_L = 50 pF		8	12	ns
			C_L = 500 pF		13	18	ns
t_{S-+}	Storage Delay Positive Edge	R_D = 10 Ω	C_L = 50 pF		8	12	ns
			C_L = 500 pF		13	18	ns
t_F	Fall Time	R_D = 10 Ω	C_L = 50 pF		6	9	ns
			C_L = 500 pF		15	22	ns
t_R	Rise Time	R_D = 10 Ω	C_L = 50 pF		6	9	ns
			C_L = 500 pF		15	22	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 DS1642, DS1672 and across the 0°C to +70°C range for the DS3642, DS3672. All typicals are given for V_{CC} = 12V and T_A = 25°C.

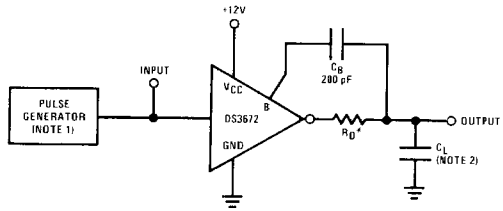
Note 3: All currents into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

Note 4: When measuring output drive current and switching response for the DS1672 and DS3672, a 10 Ω resistor should be placed in series with each output. This resistor is internal to the DS1642/DS3642 and need not be added.

Note 5: The value of I_{IH} and I_{IL} given is intended to be a measure of input impedance and does not reflect the input threshold.

Note 6: V_{OL} also applies to the fail-safe condition when the input is open.

AC Test Circuit



*Internal on DS1642/DS3642

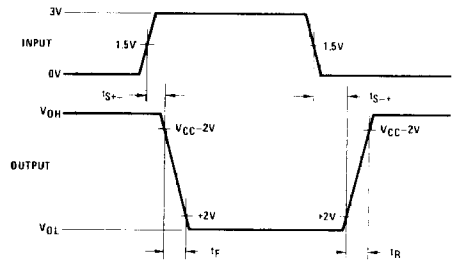
Note 1: The pulse generator has the following characteristics: PRR = 1 MHz, 50% Duty Cycle, $Z_{OUT} = 50\Omega$, $t_R = t_F \leq 10$ ns.

Note 2: C_L includes probe and jig capacitance.

Note 3: The high current transient (as high as 0.5A) through the resistance of the external interconnecting ground 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 load from the driving circuit to ground is electrically long, or has significant dc resistance, it can subtract from the switching response.

FIGURE 1

Switching Time Waveforms

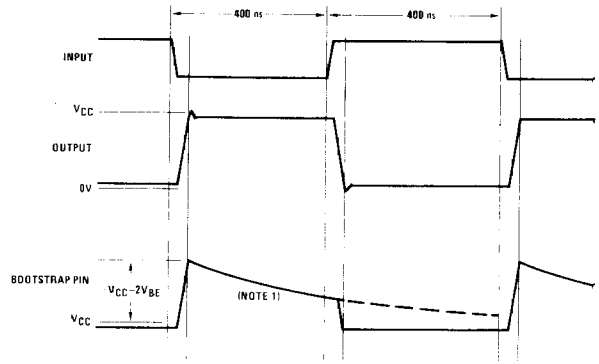


Note 1: The pulse generator has the following characteristics: PRR = 1 MHz, $t_R \leq 10$ ns, $t_F \leq 10$ ns, $Z_{OUT} = 50\Omega$.

Note 2: C_L includes probe and jig capacitance.

FIGURE 2

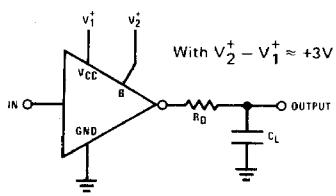
Node Voltage Waveforms



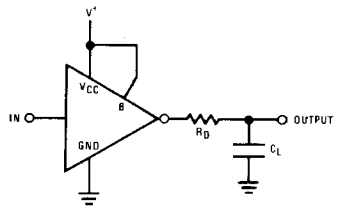
Note 1: The fall time has an exponential decay with the following time constant: $t_B = C_B R_B$. The typical value for R_B can be found in the table of electrical characteristics.

Typical Applications

DS3672 Operating with Extra Supply to Enhance Output Voltage Level



DS3672 in Non-Bootstrap Application with Single Supply—When Output High Level is Non-Critical.



DS3672 Bootstrap Mode of Application with Capacitively Coupled Input and Negative Supply