National Semiconductor

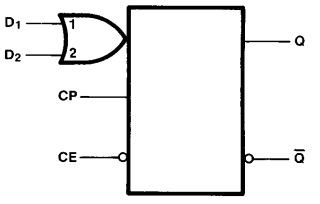
Not Intended For New Designs
August 1992

11C06
750 MHz D-Type Flip-Flop

General Description

The 11C06 is a high-speed ECL D-Type Master-Slave Flip-Flop capable of toggle rates over 750 MHz. Designed primarily for high-speed prescaling, it can also be used in any application which does not require preset inputs. The circuit is voltage-compensated, which makes input thresholds and output levels insensitive to V_{EE} variations. Complementary Q and $\overline{Q}$ outputs are provided, as are two Data inputs, Clock and Clock Enable inputs. The 11C06 is pin-compatible with the Motorola MC1690L but is a higher-frequency replacement.

Logic Symbol



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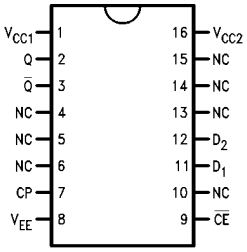
Connection Diagrams

16-Pin DIP



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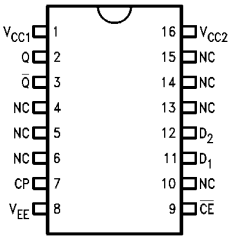
16-Pin Flatpak



TL/F/9890–2

Pin Names	Description
D_n	Data Input
CP	Clock Input
$\overline{CE}$	Clock Enable (Active LOW)
Q, $\overline{Q}$	Outputs

Truth Table

$\overline{CE}$	CP	D	Q_n
L	L	X	Q_{n-1}
L	H	X	Q_{n-1}
L	⌐	L	L
L	⌐	H	H
H	X	X	Q_{n-1}

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
⌐ = LOW to HIGH Transition
Q_{n-1} = Previous State

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Absolute Maximum Ratings

Above which the useful life may be impaired

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Storage Temperature	−65°C to +150°C
Maximum Junction Temperature (T_J)	+150°C
Supply Voltage Range	−7.0V to GND
Input Voltage (DC)	V_{EE} to GND
Output Current (DC Output HIGH)	−50 mA
Operating Range	−5.7V to −4.7V
Lead Temperature (Soldering, 10 sec.)	300°C

Recommended Operating Conditions

	Min	Typ	Max
Supply Voltage (V_{EE})	−5.7V	−5.2V	−4.7V
Ambient Temperature (T_A)	0°C		+75°C

DC Electrical Characteristics

V_{EE} = −5.2V, V_{CC} = GND

Symbol	Parameter	Min	Typ	Max	Units	T_A	Conditions
V_{OH}	Output Voltage HIGH	−1000 −960 −900		−840 −810 −720	mV mV mV	0°C +25°C +75°C	V_{IN} = $V_{IH\ (Max)}$ or $V_{IL\ (Min)}$ per Truth Table Loading 50Ω to −2V
V_{OL}	Output Voltage LOW	−1870 −1850 −1830		−1635 −1620 −1595	mV mV mV	0°C +25°C +75°C	
V_{OHC}	Output Voltage HIGH	−1020 −980 −920			mV mV mV	0°C +25°C +75°C	V_{IN} = $V_{IH\ (Min)}$ or $V_{IL\ (Max)}$ for D_n Inputs Loading 50Ω to −2V
V_{OLC}	Output Voltage LOW			−1615 −1600 −1575	mV mV mV	0°C +25°C +75°C	
V_{IH}	Input Voltage HIGH	−1135 −1095 −1035		−840 −810 −720	mV mV mV	0°C +25°C +75°C	Guaranteed Input Voltage HIGH for All Inputs
V_{IL}	Input Voltage LOW	−1870 −1850 −1830		−1500 −1485 −1460	mV mV mV	0°C +25°C +75°C	Guaranteed Input Voltage LOW for All Inputs
I_{IH}	Input Current HIGH Clock Input Data Input			 250 270	 μA μA	 +25°C +25°C	V_{IN} = $V_{IH\ (Max)}$
I_{IL}	Input Current LOW	0.5			μA	+25°C	V_{IN} = $V_{IH\ (Min)}$
I_{EE}	Power Supply Current	−59	−40		mA	+25°C	All Inputs Open

AC Electrical Characteristics

V_{EE} = −5.2V, V_{CC} = GND, T_A = +25°C

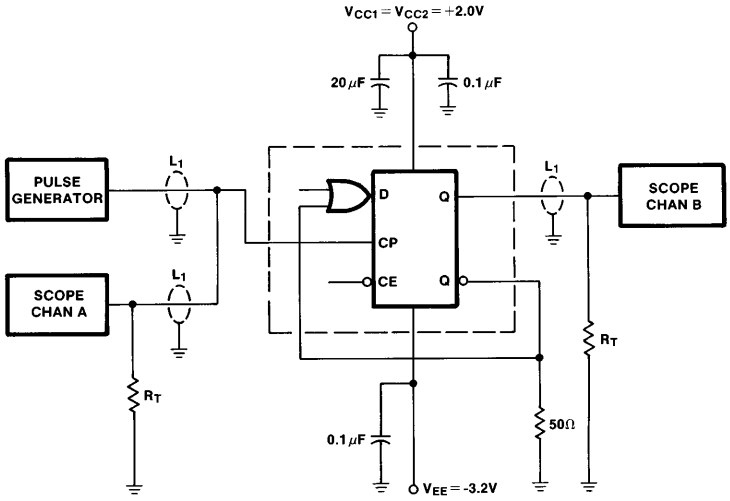
Symbol	Parameter	Min	Typ	Max	Units	Conditions
t_{PHL} t_{PLH}	Propagation Delay (CP-Q) Propagation Delay (CP-Q)	0.7 0.7	1.0 1.0	1.2 1.2	ns ns	
t_{TLH} t_{THL}	Transition Time 20% to 80% Transition Time 80% to 20%	0.5 0.5	0.8 0.8	1.0 1.0	ns ns	See *Figure 1*
t_S	Set-up Time		0.2		ns	
t_H	Hold Time		0.2		ns	
$f_{TOG\ (MAX)}$	Toggle Frequency (CP)	650	750		MHz	See *Figure 2*, Note

Note: The device is guaranteed for f_{TOG} (CP) ≥ 600 MHz, f_{TOG}(CE) ≥ 550 MHz over the 0°C to +75°C temperature range.

Functional Description

While the clock is LOW, the slave is held steady and the information on the D input is permitted to enter the master. The next transition from LOW to HIGH locks the master in its present state making it insensitive to the D input. This transition simultaneously connects the slave to the master causing the new information to appear on the outputs. Master and slave clock thresholds are internally offset in opposite directions to avoid race conditions or simultaneous master-slave changes when the clock has slow rise or fall times.

The CP and $\overline{CE}$ inputs are logically identical, but physical constraints associated with the Dual-In-Line package make the $\overline{CE}$ input slower at the upper end of the toggle range. To prevent new data from entering the master on the next CP LOW cycle, $\overline{CE}$ should go HIGH while CP is still HIGH.



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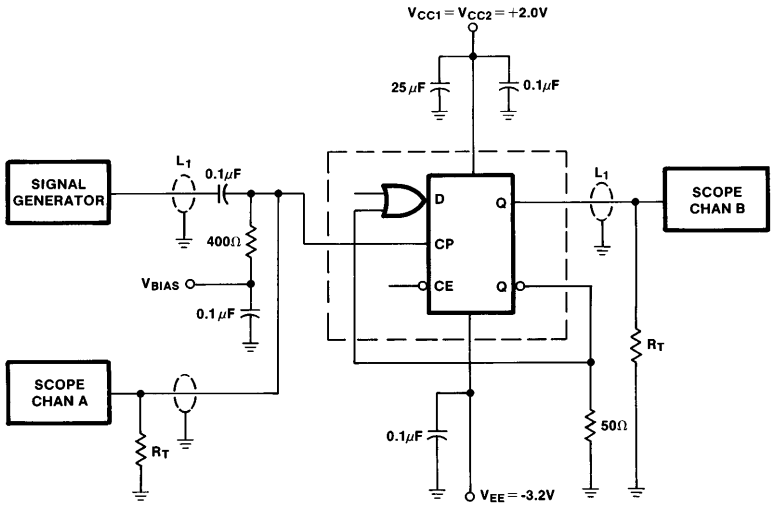
R_T = 50Ω termination of scope
L_1 = 50Ω impedance lines
All input transition times are 2.0 ns ±0.2 ns

FIGURE 1. Propagation Delay (CP to Q)

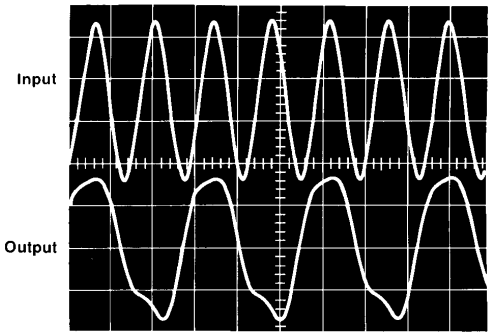


TL/F/9890–5

R_T = 50Ω termination of scope
L_1 = 50Ω impedance lines
Adjust V_{BIAS} for +0.7V baseline of 800 mV peak-to-peak sinewave input.
All input transition times are 2.0 ns ±0.2 ns

FIGURE 2. Toggle Frequency Test Circuit

Typical Waveforms



700 MHz Operation

TL/F/9890–6

Horizontal Scale = 1.0 ns/div
Vertical Scale = 200 mV/div

Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:

11C06 D C QR

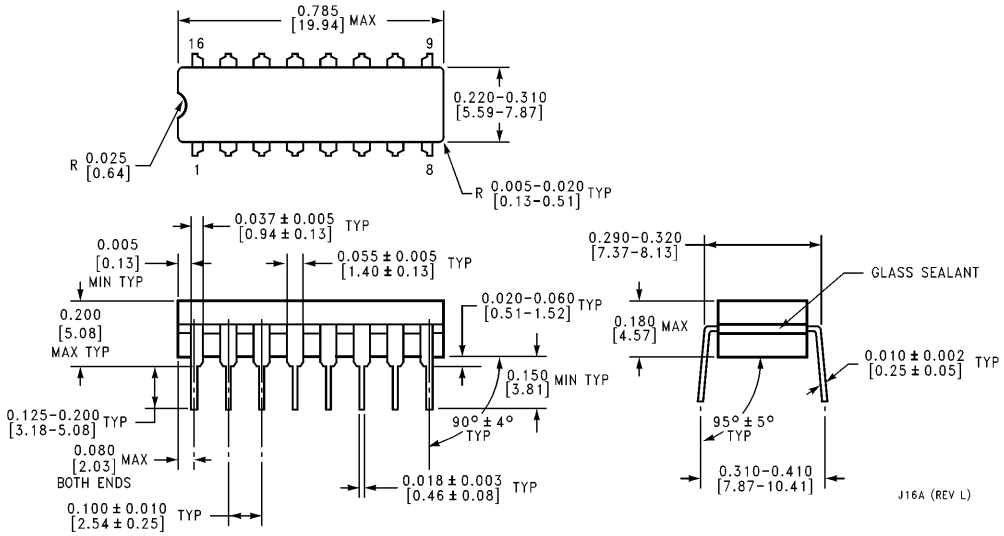
Device Number (basic)

Package Code
D = Ceramic Dual-In-Line
F = Flatpak

Temperature Range
C = Commercial (0°C to +85°C)

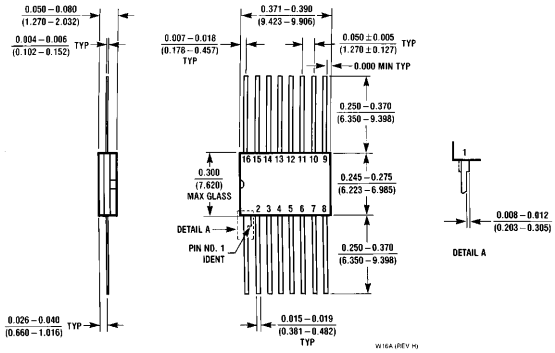
Special Variations
QR = Commercial grade device with burn-in

Physical Dimensions inches (millimeters)



16 Lead Ceramic Dual-In-Line Package (D)
NS Package Number J16A

Physical Dimensions inches (millimeters) (Continued)



16 Lead Ceramic Flatpak (F)
NS Package Number W16A

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