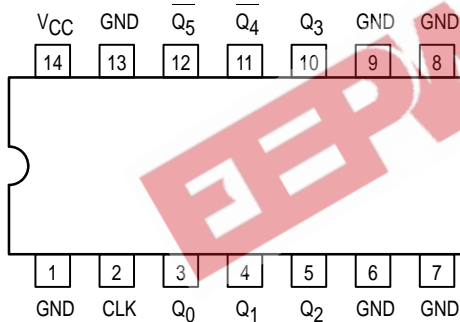


Low Skew CMOS Clock Driver

The MC88913 is a high-speed, low power, hex divide-by-two D-type flip-flop with two inverting and four non-inverting outputs that have closely matched propagation delays. With a TTL compatible buffered clock input that is common to all flip-flops, the MC88913 is ideal for use in high-frequency systems as a clock driver, providing multiple outputs that are synchronous.

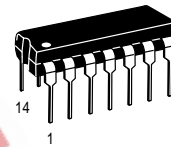
- Minimum Clock Input f_{MAX} of 110MHz
- TTL Compatible Positive Edge-Triggered Clock
- Matched Outputs for Synchronous Applications
- Outputs Source/Sink 24mA
- Part-to-Part Skew of Less Than 4.0ns
- Guaranteed Rise and Fall Times for a Given Capacitive Load

Pinout: 14-Lead Plastic (Top View)

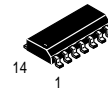


MC88913

**LOW SKEW CMOS
CLOCK DRIVER**



N SUFFIX
PLASTIC PACKAGE
CASE 646-06



D SUFFIX
PLASTIC PACKAGE
CASE 751A-03

MAXIMUM RATINGS*

Symbol	Parameter	Value	Units	
V_{CC}	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V	
V_{in}	DC Input Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V	
V_{out}	DC Output Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V	
I_{in}	DC Input Current, per Pin	± 20	mA	
I_{out}	DC Output Sink/Source Current, per Pin	± 50	mA	
I_{CC}	DC V_{CC} or GND Current per Output Pin	± 50	mA	
P_D	Power Dissipation in Still Air	Plastic Package** SOIC Package**	750 500	mW
T_{stg}	Storage Temperature	-65 to +150	$^{\circ}C$	
T_L	Lead Temperature, 1mm from Case for 10s (Plastic or SOIC Package)	260	$^{\circ}C$	

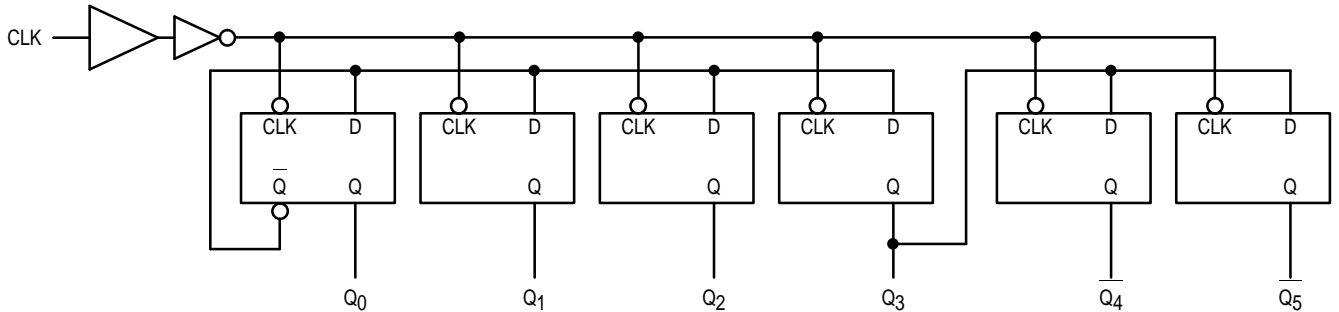
* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

** Derating: Plastic Package: -10mW/ $^{\circ}C$ from 65 $^{\circ}C$ to 125 $^{\circ}C$
SOIC Package: -7.0mW/ $^{\circ}C$ from 65 $^{\circ}C$ to 125 $^{\circ}C$



MC88913

LOGIC DIAGRAM



NOTE: This diagram is provided only for understanding of logic operation and should **not** be used to estimate propagation delays

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V _{CC}	DC Supply Voltage (Referenced to GND)	2.0	6.0	V
V _{in} , V _{out}	DC Input Voltage, Output Voltage (Referenced to GND)	0	V _{CC}	V
T _A	Operating Temperature	-40	+85	°C
t _r , t _f	Input Rise and Fall Time V _{in} from 0.8 to 2.0V V _{meas} from 0.8 to 2.0V	0	10	ns/V

DC CHARACTERISTICS (unless otherwise specified)

Symbol	Parameter		Unit	Condition
I _{CC}	Maximum Quiescent Supply Current	80	μA	V _{IN} = V _{CC} or GND V _{CC} = 5.5V, T _A = Worst Case
I _{CC}	Maximum Quiescent Supply Current	8.0	μA	V _{IN} = V _{CC} or GND V _{CC} = 5.5V, T _A = 25°C
I _{CCT}	Maximum Additional I _{CC} /Input	1.5	mA	V _{IN} = V _{CC} - 2.1V V _{CC} = 5.5V, T _A = Worst Case

AC OPERATING REQUIREMENTS

Symbol	Parameter	V _{CC} (V)	T _A = 25°C C _L = 50 pF		T _A = -40 to +85°C C _L = 50 pF		Unit
			Min	Max	Min	Max	
t _W	CLK Pulse Width (HIGH to LOW)	5.0	3.0		3.0		ns

CAPACITANCE

Symbol	Parameter	Typ	Unit	Condition
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = 5.0V
C _{PD}	Power Dissipation Capacitance	30	pF	V _{CC} = 5.0V

DC CHARACTERISTICS

Symbol	Parameter	V _{CC}	T _A = +25°C		T _A = -40 to +85°C		Unit	Conditions
			Typ	Guaranteed Max				
V _{IH}	Minimum High Level Input Voltage	4.5	1.5	2.0	2.0	V	V _{OUT} = 0.1V or V _{CC} - 0.1V	
		5.5	1.5	2.0	2.0			
V _{IL}	Maximum Low Level Input Voltage	4.5	1.5	0.8	0.8	V	V _{OUT} = 0.1V or V _{CC} - 0.1V	
		5.5	1.5	0.8	0.8			
V _{OH}	Minimum High Level	4.5	4.49	4.4	4.4	V	I _{OUT} = -50μA	
		5.5	5.49	5.4	5.4			
		4.5		3.86	3.76	V	*V _{IN} = V _{IL} or V _{IH} I _{OH} = -24mA -24mA	
		5.5		4.86	4.76			
V _{OL}	Maximum Low Level Output Voltage	4.5	0.001	0.1	0.1	V	I _{OUT} = 50μA	
		5.5	0.001	0.1	0.1			
		4.5		0.36	0.44	V	*V _{IN} = V _{IL} or V _{IH} I _{OH} = 24mA 24mA	
		5.5		0.36	0.44			
I _{IN}	Maximum Input	5.5		±0.1	±0.1	μA	V _I = V _{CC} , GND	
I _{CC}	Maximum I _{CC} /Input	5.5	0.6		1.5	mA	V _I = V _{CC} - 2.1V	
I _{OLD}	Minimum Dynamic Output Current**	5.5			75	mA	V _{OLD} = 1.65V	
I _{OHD}		5.5			-75	mA	V _{OHD} = 3.85V	

* All outputs loaded; thresholds on inputs associated with output under test.

** Maximum test duration 20ms, one output at a time.

AC CHARACTERISTICS (V_{CC} = 5.0V ±10%)

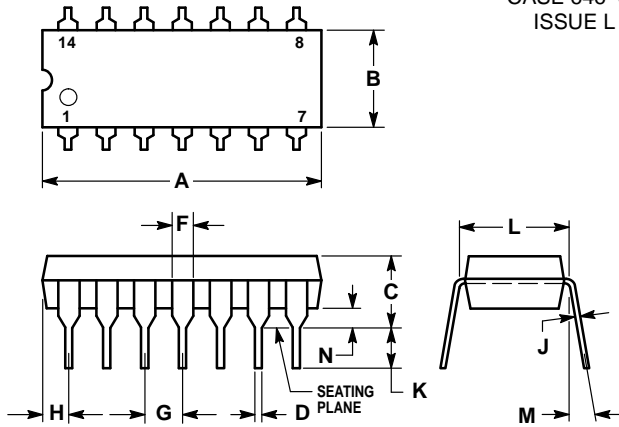
Symbol	Parameter	V _{CC} (V)	T _A = 25°C C _L = 50 pF		T _A = -40 to +85°C C _L = 50 pF		Unit
			Min	Max	Min	Max	
f _{MAX}	Maximum Clock Frequency (50% Duty Cycle)	5.0	110		110		MHz
t _{PLH} , t _{PHL}	Propagation Delay CLK to Q _n , Q _n	5.0	4.0	10.5	4.0	11.5	ns
t _{PV}	Propagation Delay Variation CLK to Q ₀ , Q ₁ , Q ₂ (see Note 1)	5.0		4.0		5.0	ns
	Propagation Delay Variation CLK to All Outputs (see Note 1)	5.0		4.5		5.5	ns
t _{PS}	Propagation Delay Skew (Q ₀ , Q ₁ , Q ₂) t _{PHL} Actual - t _{PLH} Actual	5.0		1.0		1.0	ns
	Propagation Delay Skew (All Outputs) t _{PHL} Actual - t _{PLH} Actual	5.0		1.5		1.5	ns
t _{OS}	Output-to-Output Skew (Q ₀ , Q ₁ , Q ₂) t _p Q _n - t _p Q _m (see Note 2)	5.0		1.0		1.0	ns
	Output-to-Output Skew (All Outputs) t _p Q _n - t _p Q _m (see Note 2)	5.0		1.5		1.5	ns
t _{rise} t _{fall}	Rise/Fall Time for Q ₀ , Q ₁ , Q ₂ (0.2 x V _{CC} to 0.8 x V _{CC})	5.0		3.0		4.0	ns
	Rise/Fall Time for All Outputs (0.2 x V _{CC} to 0.8 x V _{CC})	5.0		3.5		4.5	ns

1. For a given set of conditions (i.e., capacitive load, temperature and V_{CC}) the variation from device to device is guaranteed to be less than or equal to the maximum.

2. Where t_p Q_n and t_p Q_m are the actual propagation delays (any combination of HIGH or LOW) for any two separate outputs from a given high transition of CLK.

OUTLINE DIMENSIONS

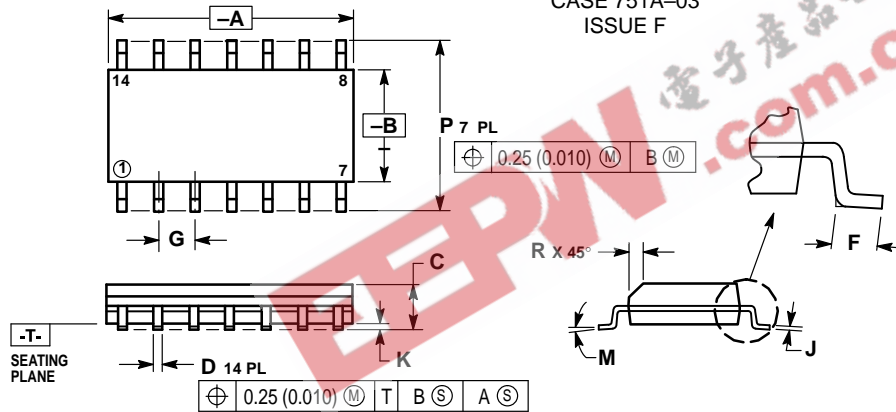
N SUFFIX
PLASTIC PACKAGE
 CASE 646-06
 ISSUE L



- NOTES:
- LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
 - DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
 - DIMENSION B DOES NOT INCLUDE MOLD FLASH.
 - ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	19.56
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.300 BSC		7.62 BSC	
M	0°	10°	0°	10°
N	0.015	0.039	0.39	1.01

D SUFFIX
PLASTIC SOIC PACKAGE
 CASE 751A-03
 ISSUE F



- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 - CONTROLLING DIMENSION: MILLIMETER.
 - DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
 - MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
 - DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

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