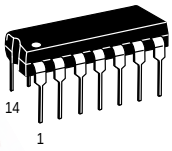
Low Skew CMOS Clock Driver

MC88913

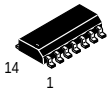
LOW SKEW CMOS CLOCK DRIVER

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

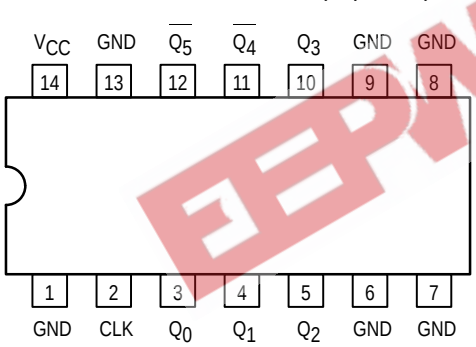


N SUFFIX
PLASTIC PACKAGE
CASE 646–06



D SUFFIX
PLASTIC PACKAGE
CASE 751A–03

Pinout: 14–Lead Plastic (Top View)



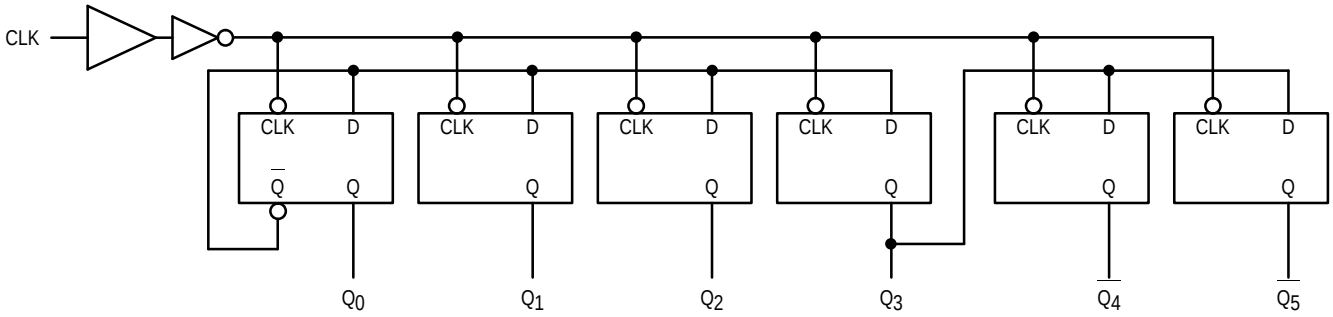
MAXIMUM RATINGS*

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	°C
T_L	Lead Temperature, 1mm from Case for 10s (Plastic or SOIC Package)	260	°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/°C from 65°C to 125°C
SOIC Package: –7.0mW/°C from 65°C to 125°C

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 0	10 8.0	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 5.5	1.5 1.5	2.0 2.0	2.0 2.0	V	V_{OUT} = 0.1V or V_{CC} – 0.1V
V_{IL}	Maximum Low Level Input Voltage	4.5 5.5	1.5 1.5	0.8 0.8	0.8 0.8	V	V_{OUT} = 0.1V or V_{CC} – 0.1V
V_{OH}	Minimum High Level	4.5 5.5	4.49 5.49	4.4 5.4	4.4 5.4	V	I_{OUT} = –50µA
		4.5 5.5		3.86 4.86	3.76 4.76	V	*V_{IN} = V_{IL} or V_{IH} I_{OH} = –24mA –24mA
V_{OL}	Maximum Low Level Output Voltage	4.5 5.5	0.001 0.001	0.1 0.1	0.1 0.1	V	I_{OUT} = 50µA
		4.5 5.5		0.36 0.36	0.44 0.44	V	*V_{IN} = V_{IL} or V_{IH} I_{OH} = 24mA 24mA
I_{IN}	Maximum Input	5.5		±0.1	±0.1	µA	V_I = V_{CC}, GND
I_{CCT}	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.

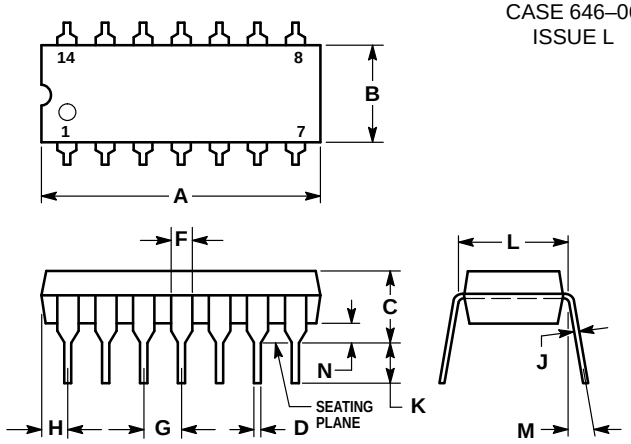
AC CHARACTERISTICS (V_{CC} = 5.0V ±10%)

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, $\overline{Q_n}$	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) $\lvert t_{PHL}$ Actual – t_{PLH} Actual$\rvert$	5.0		1.0		1.0	ns
	Propagation Delay Skew (All Outputs) $\lvert t_{PHL}$ Actual – t_{PLH} Actual$\rvert$	5.0		1.5		1.5	ns
t_{OS}	Output–to–Output Skew (Q_0, Q_1, Q_2) $\lvert t_p\ Q_n - t_p\ Q_m\rvert$ (see Note 2)	5.0		1.0		1.0	ns
	Output–to–Output Skew (All Outputs) $\lvert t_p\ Q_n - t_p\ Q_m\rvert$ (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

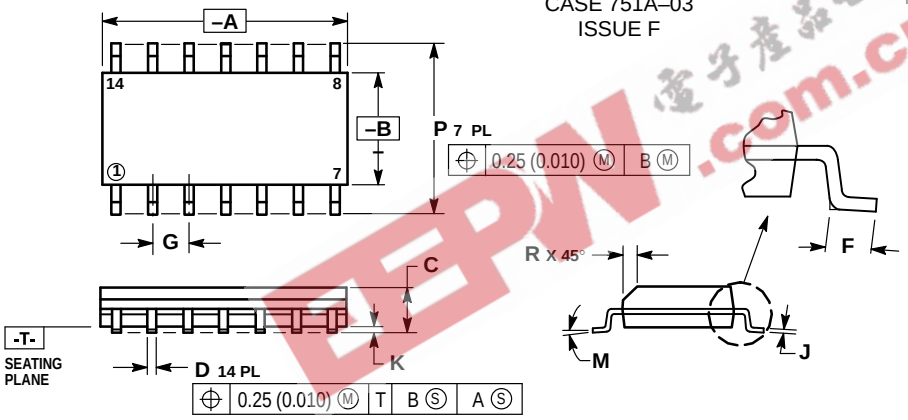
N SUFFIX
PLASTIC PACKAGE
CASE 646–06
ISSUE L



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

	INCHES		MILLIMETERS	
DIM	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:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. 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.

	MILLIMETERS		INCHES	
DIM	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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