



MOTOROLA

QUAD PRECISION TIMER/DRIVER

The MC14415 quad timer/driver is constructed with complementary MOS enhancement mode devices. The output pulse width of each digital timer is a function of the input clock frequency. Once the proper input sequence is detected the output buffer is set (turned on), and after 100 clock pulses are counted, the output buffer is reset (turned off).

The MC14415 was designed specifically for application in high speed line printers to provide the critical timing of the hammer drivers, but may be used in many applications requiring precision pulse widths.

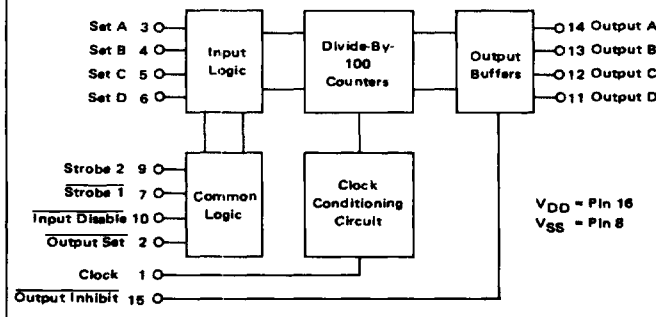
- Four Precision Digital Time Delays
- Schmitt Trigger Clock Conditioning
- NPN Bipolar Output Drivers
- Timing Disable Capability Using Inhibit Output
- Positive or Negative Edge Strobing on the Inputs
- Synchronous Polynomial Counters Used for Delay Counting
- Power Supply Operating Range
3.0 Vdc to 18 Vdc (MC14415EFL/FL/FP)
3.0 Vdc to 6.0 Vdc (MC14415EVL/L/VP)

MAXIMUM RATINGS* (Voltages Referenced to V_{SS})

Symbol	Parameter	Value	Unit
V _{DD}	DC Supply Voltage - MC14415EFL/FL/FP MC14415EVL/L/VP	-0.5 to +18.0 -0.5 to +6.0	V
V _{in} , V _{out}	Input or Output Voltage (DC or Transient)	-0.5 to V _{DD} + 0.5	V
I _{in}	Input Current (DC or Transient), per Pin	± 10	mA
I _{out}	Output Current (DC or Transient), per Pin	± 20	mA
P _D	Power Dissipation, per Package†	500	mW
T _{stg}	Storage Temperature	-65 to +150	°C
T _L	Lead Temperature (8-Second Soldering)	260	°C

*Maximum Ratings are those values beyond which damage to the device may occur.
 †Temperature Derating: Plastic "P" Package: -12mW/°C from 85°C to 85°C
 Ceramic "L" Package: -12mW/°C from 100°C to 125°C

BLOCK DIAGRAM

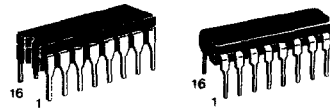


MC14415

CMOS LSI

(LOW-POWER COMPLEMENTARY MOS)

QUAD PRECISION TIMER/DRIVER



L SUFFIX
CERAMIC PACKAGE
CASE 620

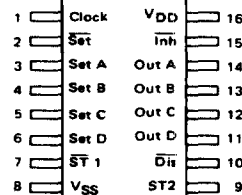
P SUFFIX
PLASTIC PACKAGE
CASE 648

ORDERING INFORMATION

Operating Range: -55°C to +125°C
MC14415EFL (3 to 18 V, Ceramic Package)
MC14415EVL (3 to 6 V, Ceramic Package)

Operating Range: -40°C to +85°C
MC14415FL (3 to 18 V, Ceramic Package)
MC14415FP (3 to 18 V, Plastic Package)
MC14415VL (3 to 6 V, Ceramic Package)
MC14415VP (3 to 6 V, Plastic Package)

PIN ASSIGNMENT



MC14415

ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

Characteristic	Symbol	VDD Vdc	T _{low} *		25°C			T _{high} *		Unit	
			Min	Max	Min	Typ #	Max	Min	Max		
Output Voltage (No Load)	"0" Level V_{OL}	5.0	—	0.01	—	0	0.01	—	0.05	Vdc	
		10	—	0.01	—	0	0.01	—	0.05		
		15	—	—	—	—	—	—	—		
	"1" Level V_{OH}	5.0	—	—	3.0	4.14	—	—	—	Vdc	
		10	—	—	8.0	9.09	—	—	—		
		15	—	—	—	14.12	—	—	—		
Noise Immunity ($\Delta V_{out} < 1.5$ Vdc) ($\Delta V_{out} < 3.0$ Vdc) ($\Delta V_{out} < 4.5$ Vdc)	V_{NL}	5.0	1.5	—	1.5	2.25	—	1.4	—	Vdc	
		10	3.0	—	3.0	4.50	—	2.9	—		
		15	—	—	—	6.75	—	—	—		
	V_{NH}	5.0	1.4	—	1.5	2.25	—	1.5	—	Vdc	
		10	2.9	—	3.0	4.50	—	3.0	—		
		15	—	—	—	6.75	—	—	—		
Output Drive Voltage (NPN Driver) Source	V_{OH}	5.0	—	—	3.0	4.14	—	—	—	Vdc	
			($I_{OH} = 0$ mA)	—	—	2.7	3.44	—	—		—
			($I_{OH} = 5.0$ mA)	—	—	2.5	3.30	—	—		—
			($I_{OH} = 10$ mA)	—	—	2.2	3.08	—	—		—
			($I_{OH} = 15$ mA)	—	—	—	—	—	—		—
			($I_{OH} = 15$ mA)	—	—	—	—	—	—		—
	10	—	—	—	8.0	9.09	—	—	—	Vdc	
		($I_{OH} = 0$ mA)	—	—	7.7	8.45	—	—	—		
		($I_{OH} = 5.0$ mA)	—	—	7.5	8.30	—	—	—		
		($I_{OH} = 10$ mA)	—	—	7.1	8.14	—	—	—		
		($I_{OH} = 15$ mA)	—	—	—	—	—	—	—		
		($I_{OH} = 15$ mA)	—	—	—	—	—	—	—		
15	—	—	—	—	14.12	—	—	—	Vdc		
	($I_{OH} = 0$ mA)	—	—	—	13.81	—	—	—			
	($I_{OH} = 5.0$ mA)	—	—	—	13.70	—	—	—			
	($I_{OH} = 10$ mA)	—	—	—	13.61	—	—	—			
	($I_{OH} = 15$ mA)	—	—	—	—	—	—	—			
	($I_{OH} = 15$ mA)	—	—	—	—	—	—	—			
Output Drive Current ($V_{OL} = 0.4$ Vdc) ($V_{OL} = 0.5$ Vdc) ($V_{OL} = 1.5$ Vdc)	Sink I_{OL}	5.0	0.23	—	0.20	0.78	—	0.16	—	mA	
		10	0.60	—	0.50	2.0	—	0.40	—		
		15	—	—	—	7.8	—	—	—		
		15	—	—	—	—	—	—	—		
Input Leakage Current	I_{in}	15	—	±0.3	—	±0.00001	±0.3	—	±1.0	μA	
Input Capacitance ($V_{in} = 0$)	C_{in}	—	—	—	—	5.0	—	—	—	pF	
Quiescent Dissipation	P_Q	5.0	—	0.25	—	0.00005	0.25	—	3.5	mW	
		10	—	1.0	—	0.00022	1.0	—	14		
		15	—	—	—	0.00050	—	—	—		
		15	—	—	—	—	—	—	—		
Power Dissipation** (Dynamic plus Quiescent) ($C_L = 15$ pF)	P_D	5.0	$P_D = (56 \text{ mW/MHz}) f + P_Q$ $P_D = (225 \text{ mW/MHz}) f + P_Q$ $P_D = (510 \text{ mW/MHz}) f + P_Q$							mW	
		10									
		15									
		15									

*T_{low} = -55°C for MC14415EFL, EVL; -40°C for MC14415FL, FP, VL, VP
 T_{high} = +125°C for MC14415EFL, EVL; +85°C for MC14415FL, FP, VL, VP

**The formulas given are for the typical characteristics only.

#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}).
 Unused outputs must be left open.

MC14415

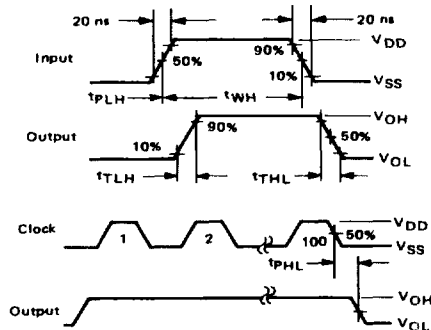
SWITCHING CHARACTERISTICS* ($C_L = 15 \text{ pF}$, $T_A = 25^\circ\text{C}$)

Characteristic	Symbol	VDD Vdc	Min	Typ #	Max	Unit
Output Rise Time $t_{TLH} = (2.0 \text{ ns/pF}) C_L + 10 \text{ ns}$ $t_{TLH} = (1.25 \text{ ns/pF}) C_L + 6 \text{ ns}$ $t_{TLH} = (1.10 \text{ ns/pF}) C_L + 3 \text{ ns}$	t_{TLH}	5.0 10 15	-- -- --	40 25 20	85 80 --	ns
Output Fall Time $t_{THL} = (1.5 \text{ ns/pF}) C_L + 47 \text{ ns}$ $t_{THL} = (0.75 \text{ ns/pF}) C_L + 24 \text{ ns}$ $t_{THL} = (0.55 \text{ ns/pF}) C_L + 17 \text{ ns}$	t_{THL}	5.0 10 15	-- -- --	70 35 25	150 80 --	ns
Turn-Off Delay Time $t_{PLH} = (2.7 \text{ ns/pF}) C_L + 560 \text{ ns}$ $t_{PHL} = (1.2 \text{ ns/pF}) C_L + 282 \text{ ns}$ $t_{PLH} = (0.91 \text{ ns/pF}) C_L + 286 \text{ ns}$	t_{PLH}	5.0 10 15	-- -- --	600 300 150	1200 600 --	ns
Turn-On Delay Time $t_{PHL} = (2.4 \text{ ns/pF}) C_L + 564 \text{ ns}$ $t_{PLH} = (1.0 \text{ ns/pF}) C_L + 285 \text{ ns}$ $t_{PHL} = (0.75 \text{ ns/pF}) C_L + 289 \text{ ns}$	t_{PHL}	5.0 10 15	-- -- --	600 300 150	1200 600 --	ns
Turn-On Delay Time (Inhibit to Output)	t_{PHL}	5.0 10 15	-- -- --	300 225 110	550 425 --	ns
Turn-Off Delay Time (Inhibit to Output)	t_{PLH}	5.0 10 15	-- -- --	300 225 110	550 425 --	ns
Input Pulse Coincidence (Figure 3)	PC_{min}	5.0 10 15	500 450 --	450 350 --	-- -- --	ns
Input Pulse Width (Figure 1)	t_{WH}	5.0 10 15	500 450 --	450 350 --	-- -- --	ns
Input Clock Frequency	f_{cl}	5.0 10 15	-- -- --	0.7 1.0 1.5	-- -- --	MHz
Clock Input Rise and Fall Times (Figure 1)	t_{TLH}, t_{THL}	5.0 10 15	-- -- --	-- -- --	15 5.0 4.0	μs

*The formulas given are for the typical characteristics only at 25°C.

#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

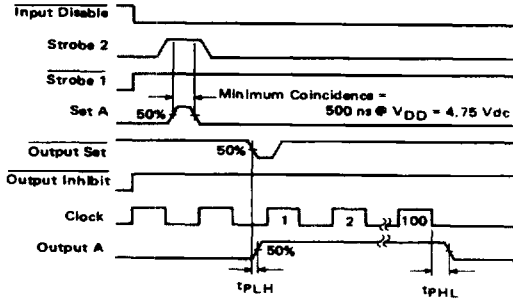
FIGURE 1 – SWITCHING CHARACTERISTICS – WAVEFORM RELATIONSHIPS



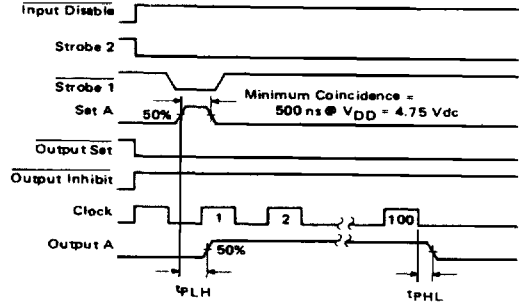
MC14415

FIGURE 2 — TYPICAL OPERATION MODES AND FUNCTIONAL TIMING DIAGRAM

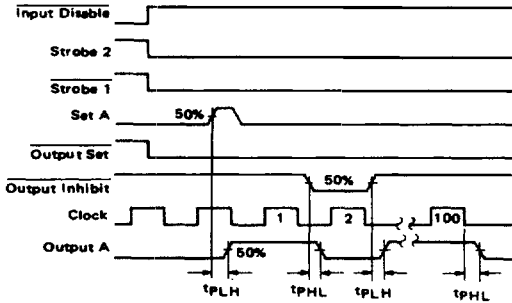
MODE 1 — OUTPUT SET INITIATES TIME DELAY



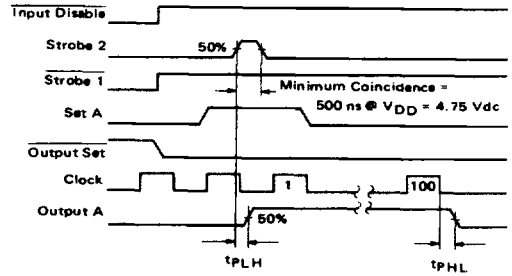
MODE 2 : SET A INITIATES TIME DELAY



MODE 3: OUTPUT INHIBIT DISABLES TIME DELAY



MODE 4: POSITIVE-EDGE STROBE (ST2) INITIATES TIME DELAY



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MC14415

LOGIC DIAGRAM

