MOTOROLA

MC14451

OSCILLATOR/2^{11} to 2^{19} DIVIDER/BUFFERED DUTY CYCLE CONTROL

The MC14451 consists of three sections: an oscillator, an 18-stage divider, and a buffered flip-flop for pulse width control and current sink drive. These circuits employ metal-gate complementary MOS devices for low-voltage operation and extremely low power dissipation.

A wide variety of output pulse widths and frequencies can be obtained using the pulse-width-control flip-flop. The number of combinations can be further increased by the variety of crystal frequencies or R-C networks used with the oscillator section.

The buffered output of the duty-cycle-control flip-flop consists of an N-channel MOSFET for maximum current sinking capability and a P-channel active pullup device. Outputs from the 18-stage divider section provide a negative logic binary count.

Applications of the MC14451 include power-off timers, low-power-consumption timers especially suited for battery applications, elapsed timers, wall clocks, auto-timers for feeding systems, fuse timers, incubator timers, weather measurement equipment, and many other battery or low-power applications.

- On-Chip Duty Cycle Control
- Buffered Duty Cycle Control Output
- On-Chip Oscillator
- Low Power Consumption — 20 μW typical @ 1.5 Vdc and f = 262 kHz.
- Operating Supply Voltage Range = 1.3 to 3.0 Vdc
- Diode Protection on Inputs

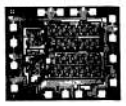
CMOS MSI

(LOW-POWER COMPLEMENTARY MOS)

OSCILLATOR/2^{11} to 2^{19} DIVIDER/ BUFFERED DUTY CYCLE CONTROL

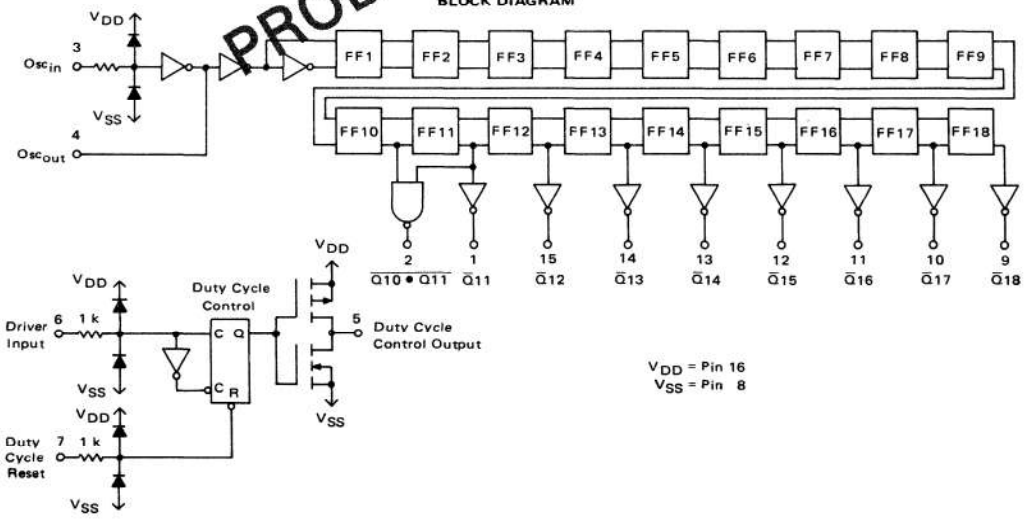
L SUFFIX
CERAMIC PACKAGE
CASE 620

P SUFFIX
PLASTIC PACKAGE
CASE 648



MCC PREFIX
CHIP

BLOCK DIAGRAM



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MAXIMUM RATINGS (Voltages referenced to V_{SS}, Pin 8)

Rating	Symbol	Value	Unit
DC Supply Voltages	V_{DD}	+3.0 to -0.5	Vdc
Input Voltage, All Inputs	V_{in}	V_{DD} +0.5 to V_{SS} -0.5	Vdc
DC Current Drain per Pin	I	10	mAdc
Operating Temperature Range	T_A	-10 to +60	°C
Storage Temperature Range	T_{stg}	-30 to +85	°C

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \leq (V_{in}$ 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}).

ELECTRICAL CHARACTERISTICS (V_{DD} = 1.58 Vdc, V_{SS} = 0, T_A = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
Power Supply Operating Range		V_{DD}	1.3	1.5	3.0	Vdc
Output Voltage		V_{OH}	1.38	1.5	–	Vdc
		V_{OL}	–	0.0	0.2	Vdc
Output Drive Current		I_{OH}				μAdc
(V_{OH} = 1.3 Vdc)	Divider Outputs		-8.0	-25	–	
	Duty Cycle Control Output		-8.0	-25	–	
(V_{OL} = 0.2 Vdc)	Divider Outputs	I_{OL}	15	50	–	μAdc
	Duty Cycle Control Output		400	1200	–	
Input Current		I_{in}	–	0.00001	–	μAdc
Quiescent Device Current		I_Q	–	1.0	15	μAdc
Dynamic Device Current (f = 262.144 kHz, no output load)		I_{DD}	–	20	200	μAdc
Minimum Voltage Required for Oscillator Start		V_{DDS}	–	1.2	1.5	Vdc

TYPICAL OSCILLATOR CIRCUITS

FIGURE 1 – 262-kHz CIRCUIT

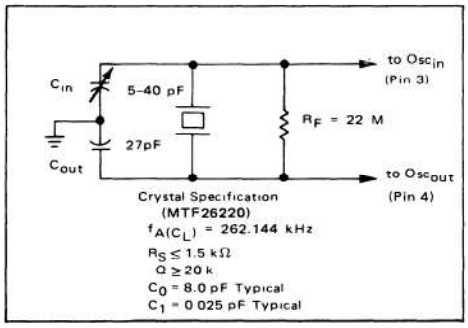

FIGURE 2 – 32.768 kHz CIRCUIT

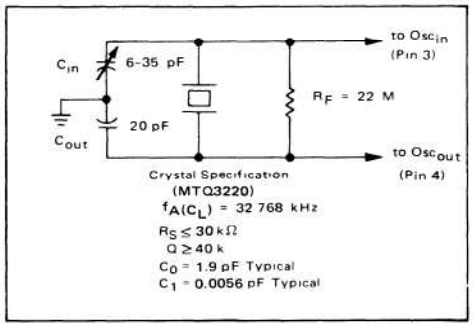

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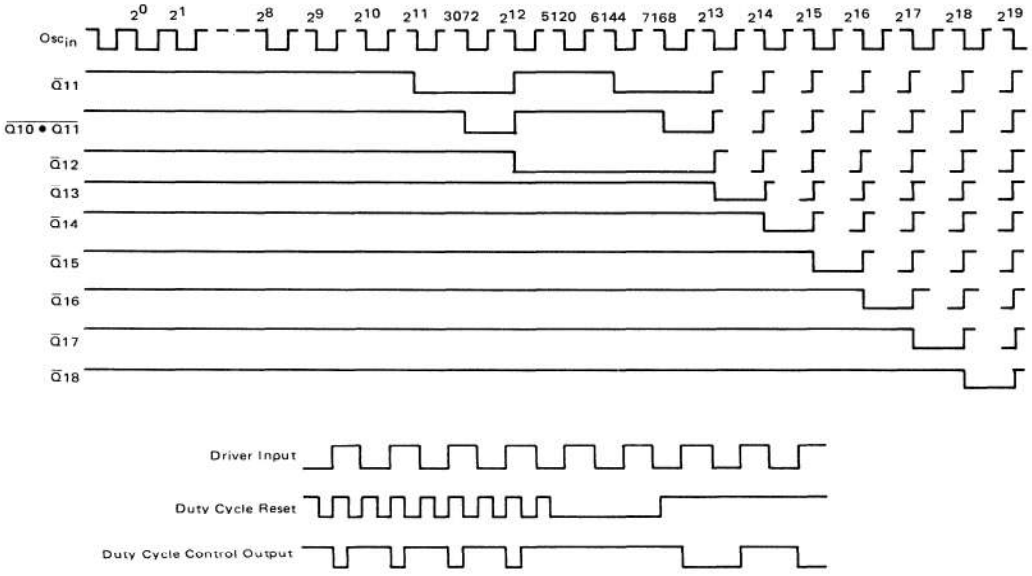
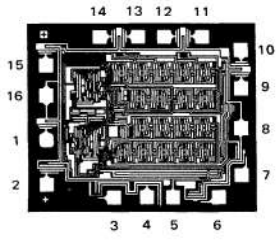
FIGURE 3 – TIMING DIAGRAM



MCC14451 BONDING PADS



Die Size: 67 x 69 mils

Chip geometry subject to change without notice as modifications are made.

Due to die cleavage angles, the actual size of the chip could be up to 7.0 mils (0.17 mm) larger than indicated in both dimensions.

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FIGURE 4 – FUNCTIONAL MATRIX

Crystal Frequency = 262.144 kHz

Pin 6 (Driver Input) Connected To:	Characteristic	Pin 7 (Duty Cycle Reset) Connected To:								
		Pin 1 $\overline{Q11}$	Pin 2 $\overline{Q10 \cdot Q11}$	Pin 15 $\overline{Q12}$	Pin 14 $\overline{Q13}$	Pin 13 $\overline{Q14}$	Pin 12 $\overline{Q15}$	Pin 11 $\overline{Q16}$	Pin 10 $\overline{Q17}$	Pin 9 $\overline{Q18}$
Pin 9 $\overline{Q18}$	Pulse Width f_{out}	3.9 ms 1 Hz	5.85 ms 1 Hz	7.8 ms 1 Hz	15.62 ms 1 Hz	31.25 ms 1 Hz	62.5 ms 1 Hz	125 ms 1 Hz	250 ms 1 Hz	500 ms 1 Hz
Pin 10 $\overline{Q17}$	Pulse Width f_{out}	3.9 ms 2 Hz	5.85 ms 2 Hz	7.8 ms 2 Hz	15.62 ms 2 Hz	31.25 ms 2 Hz	62.5 ms 2 Hz	125 ms 2 Hz	250 ms 2 Hz	
Pin 11 $\overline{Q16}$	Pulse Width f_{out}	3.9 ms 4 Hz	5.85 ms 4 Hz	7.8 ms 4 Hz	15.62 ms 4 Hz	31.25 ms 4 Hz	62.5 ms 4 Hz	125 ms 4 Hz		
Pin 12 $\overline{Q15}$	Pulse Width f_{out}	3.9 ms 8 Hz	5.85 ms 8 Hz	7.8 ms 8 Hz	15.62 ms 8 Hz	31.25 ms 8 Hz	62.5 ms 8 Hz			
Pin 13 $\overline{Q14}$	Pulse Width f_{out}	3.9 ms 16 Hz	5.85 ms 16 Hz	7.8 ms 16 Hz	15.62 ms 16 Hz	31.25 ms 16 Hz				
Pin 14 $\overline{Q13}$	Pulse Width f_{out}	3.9 ms 32 Hz	5.85 ms 32 Hz	7.8 ms 32 Hz	15.62 ms 32 Hz					
Pin 15 $\overline{Q12}$	Pulse Width f_{out}	3.9 ms 64 Hz	5.85 ms 64 Hz	7.8 ms 64 Hz						
Pin 1 $\overline{Q11}$	Pulse Width f_{out}	3.9 ms 128 Hz								

Crystal Frequency = 32.768 kHz

Pin 6 (Driver Input) Connected To:	Characteristic	Pin 7 (Duty Cycle Reset) Connected To:								
		Pin 1 $\overline{Q11}$	Pin 2 $\overline{Q10 \cdot Q11}$	Pin 15 $\overline{Q12}$	Pin 14 $\overline{Q13}$	Pin 13 $\overline{Q14}$	Pin 12 $\overline{Q15}$	Pin 11 $\overline{Q16}$	Pin 10 $\overline{Q17}$	Pin 9 $\overline{Q18}$
Pin 9 $\overline{Q18}$	Pulse Width f_{out}	31 3 ms 0 125 Hz	46.8 ms 0.125 Hz	62.5 ms 0.125 Hz	125 ms 0.125 Hz	250 ms 0.125 Hz	500 ms 0.125 Hz	1000 ms 0.125 Hz	2000 ms 0.125 Hz	4000 ms 0.125 Hz
Pin 10 $\overline{Q17}$	Pulse Width f_{out}	31.3 ms 0.25 Hz	46.8 ms 0.25 Hz	62.5 ms 0.25 Hz	125 ms 0.25 Hz	250 ms 0.25 Hz	500 ms 0.25 Hz	1000 ms 0.25 Hz	2000 ms 0.25 Hz	
Pin 11 $\overline{Q16}$	Pulse Width f_{out}	31.3 ms 0.5 Hz	46.8 ms 0.5 Hz	62.5 ms 0.5 Hz	125 ms 0.5 Hz	250 ms 0.5 Hz	500 ms 0.5 Hz	1000 ms 0 5 Hz		
Pin 12 $\overline{Q15}$	Pulse Width f_{out}	31.3 ms 1 Hz	46.8 ms 1 Hz	62.5 ms 1 Hz	125 ms 1 Hz	250 ms 1 Hz	500 ms 1 Hz			
Pin 13 $\overline{Q14}$	Pulse Width f_{out}	31.3 ms 2 Hz	46.8 ms 2 Hz	62.5 ms 2 Hz	125 ms 2 Hz	250 ms 2 Hz				
Pin 14 $\overline{Q13}$	Pulse Width f_{out}	31.3 ms 4 Hz	46.8 ms 4 Hz	62.5 ms 4 Hz	125 ms 4 Hz					
Pin 15 $\overline{Q12}$	Pulse Width f_{out}	31.3 ms 8 Hz	46.8 ms 8 Hz	62.5 ms 8 Hz						
Pin 1 $\overline{Q11}$	Pulse Width f_{out}	31.3 ns 16 Hz								

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