COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

Columbia Integrated Systems Laboratory

MOSIS

DIGITAL CLOCK DATASHEET

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- 28 I/O Pins
- 1.2V Power Supply
- Power Source:
  - Portable 9V External Battery
  - 32.768 kHz Operating Frequency
- 2 Frequency Sources:
  - On chip Crystal Oscillator
  - External Function Generator
- Digital Output for Hours, Mins, Secs
- 6 Time Division Multiplexed(TDM) Decimal Digits for hours, mins, secs
- 6 Enable Signals for Each Decimal Digit
- Time Mode & Setting Mode
- Asynchronous Reset Mode
- 1 Hz Test Pin
- ESD Protection
- Low Power

2. Description

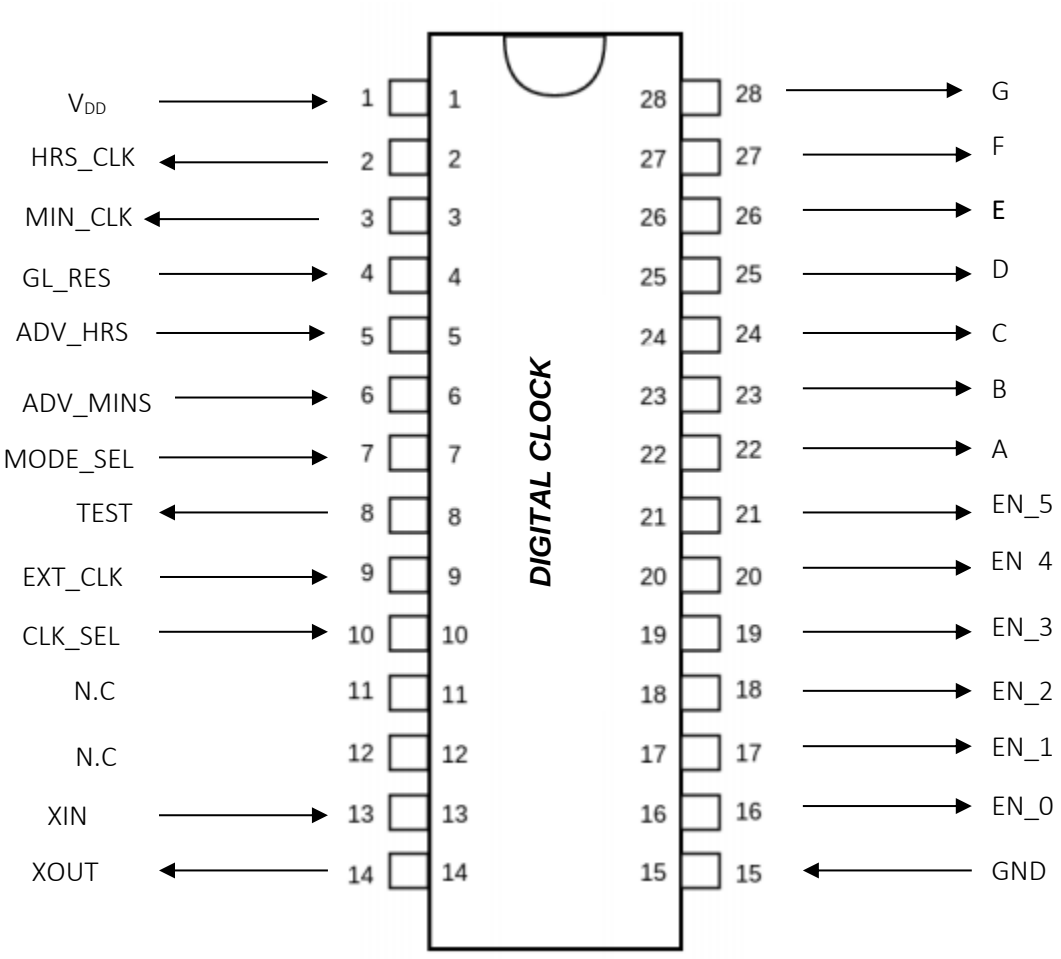
The chip is designed to function as a digital clock. It receives a frequency of 32.768 kHz dividing it appropriately to output time in 6 display segments (2 for hours, 2 for minutes and 2 for seconds). The frequency can be received from 2 different time-bases :

- An on-board crystal oscillator
- An external function generator

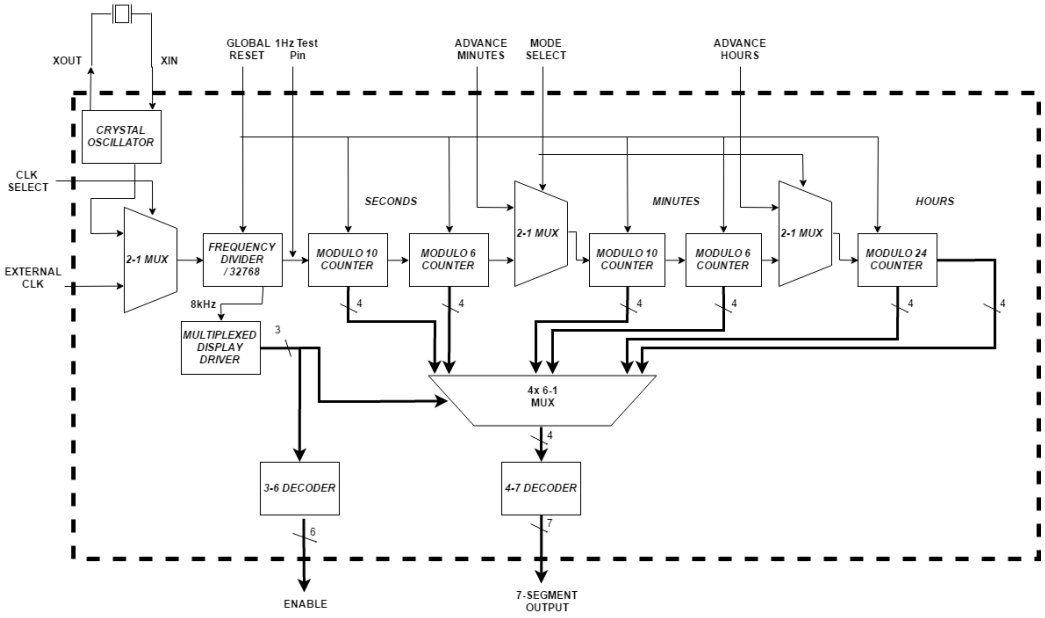
The chip also includes a setting mode to adjust the time appropriately, as well as a reset mode. Finally, it can receive the frequency signal from 2 different sources:

- A crystal connected to an on-chip oscillator
- An external frequency generator or an external crystal oscillator

3. Pin Configuration



4. Block Diagram & Pin Functions



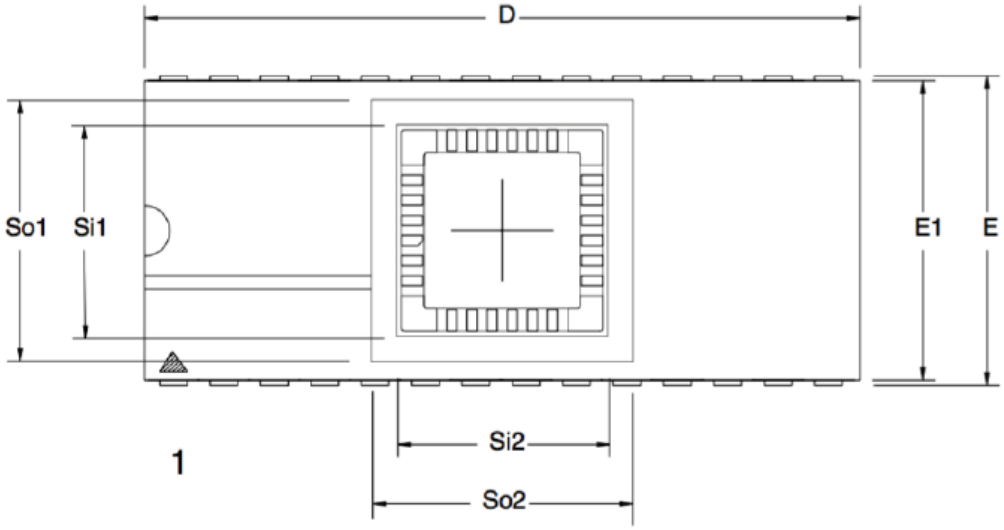
*Dotted line represents the chip's border.

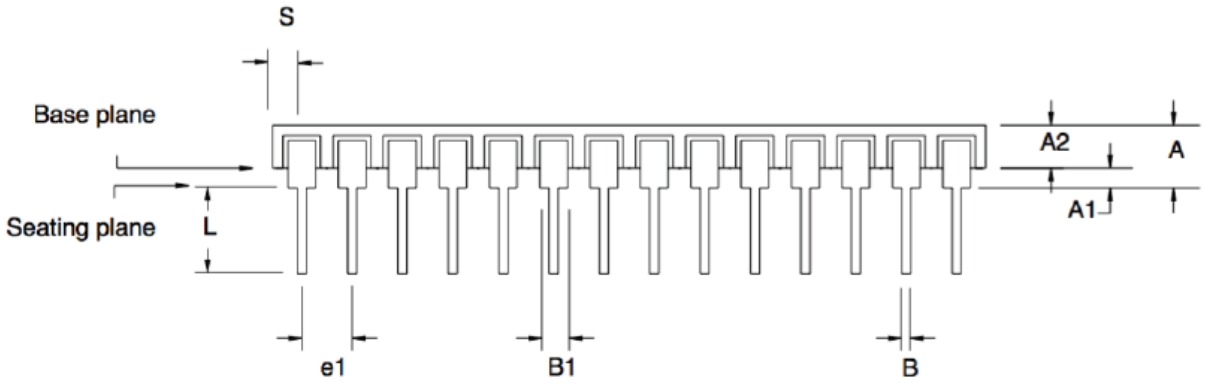
Pin #	Pin Name	Description	Pin Type	Typical	Range
1	Vdd	Power Supply	DIGITAL IN	1.2V	1.0-1.4V
2	HRS_CLK	1/hour frequency	DIGITAL OUT	H, L	0V-1.2V
3	MIN_CLK	1/min frequency	DIGITAL OUT	H, L	0V-1.2V
4	RESET	Asyncronous Global Reset	DIGITAL IN	H, L	0V-1.2V
5	ADV_HOURS	Increment Hours	DIGITAL IN	H, L	0V-1.2V
6	ADV_MIN	Increment Minutes	DIGITAL IN	H, L	0V-1.2V
7	MODE_SEL	Mode Selector	DIGITAL IN	H, L	0V-1.2V
8	TEST_PIN	1Hz Test Pin	Signal	Square Wave 1.2Vpp	0-1.2Vpp
9	EXT_CLK	32.768 kHz External Clock	Signal	Square Wave 1.2Vpp	0-1.2Vpp
10	CLK_SEL	Timebase Selector	DIGITAL IN	H, L	0V-1.2V
11	NC	-	-	-	-
12	NC	-	-	-	-
12	XIN	Oscillator IN	Signal	Sine Wave 1.2Vpp	0-1.2Vpp
13	XOUT	Oscillator OUT	Signal	Square Wave 1.2Vpp	0-1.2Vpp
14	XIN	Oscillator IN	Signal	Sine Wave 1.2Vpp	0-1.2Vpp
15	GND	Ground	DIGITAL IN	H, L	-
6	EN5	Hours MSD Enabler	DIGITAL OUT	H, L	0V-1.2V
10	EN4	Hours LSD Enabler	DIGITAL OUT	H, L	0V-1.2V
7	EN3	Minutes MSD Enabler	DIGITAL OUT	H, L	0V-1.2V
8	EN2	Minutes LSD Digit	DIGITAL OUT	H, L	0V-1.2V
9	EN1	Seconds MSD Enabler	DIGITAL OUT	H, L	0V-1.2V
10	EN0	Seconds LSD Enabler	DIGITAL OUT	H, L	0V-1.2V
11	G	7 Segment Numeric Display	DIGITAL OUT	H, L	0V-1.2V
12	F	7 Segment Numeric Display	DIGITAL OUT	H, L	0V-1.2V
13	E	7 Segment Numeric Display	DIGITAL OUT	H, L	0V-1.2V
14	D	7 Segment Numeric Display	DIGITAL OUT	H, L	0V-1.2V
15	C	7 Segment Numeric Display	DIGITAL OUT	H, L	0V-1.2V
16	B	7 Segment Numeric Display	DIGITAL OUT	H, L	0V-1.2V

*H :High, L:Low

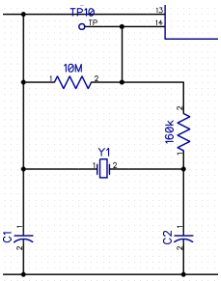
5. Packaging Information

MOSIS DIP28 packaging



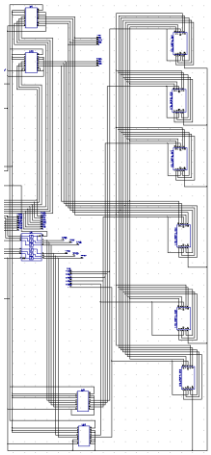


6. External Components



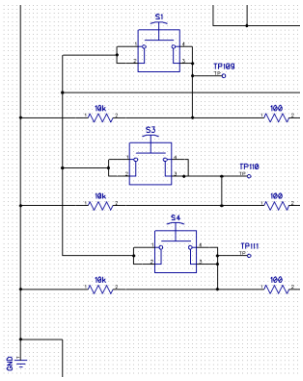
- **32.768 kHz Crystal**

The clock frequency is provided by an off chip crystal connected at pins 13 & 14 (XIN & XOUT) . A suggested circuitry is shown.



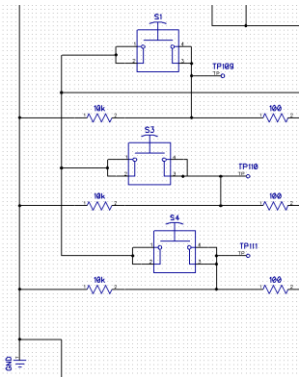
- **LED Displays**

If common anode (ca) LEDs are selected, then Pins 22-28 must be inverted. Else if common cathode (cc) LEDs are selected, then Pins 16-21 must be invertred. Pins 22-28 (A-G) provide the voltage of the 7-segments (A-G). Pins 16-21 provide the Common Cathode (cc) off the 6 LEDs. An example connectivity is shown. It utilizes 4 level shifters and a hex Schmitt Trigger.



- **Setting Mode Switches**

Pins 4,5 & 6 concern the setting mode. They are active high and normally off. A push button or slide switch with return are suggested.



- **Mode Select & Clock Select**

Pins 7 & 10 are select pins. They are either High or Low and the require a shunt switch or a slide switch.