

IZ6099AU

DIGITAL WATCH CIRCUIT

The IZ6099AU is low threshold voltage, ion implanted poli-Si gate CMOS integrated circuit which provides all signals to drive a duplexed 3.5-digit liquid crystal display with color . 32.768Hz frequency from a crystal controlled oscillator is divided to provide second, minute, hour, date, and month information. Phase controlled segment outputs and two-phase controlled back plane outputs are provided for direct drive of the duplexed LCD. The IZ6099AU contains an inverter/amplifier, output attenuating resistor, capacitor and feedback resistor to drive the crystal.

The frequency of the oscillator is divided to provide a 512Hz output pulse used as signal for the voltage doubler.

FEATURES

- 5 functions: month, date, hour, minute and second
- Selective alternation of time-date display mode
- One-touch correction of time error within ± 30 seconds
- 4-year calendar
- 2-switch sequential operating
- LCD test

FUNCTIONS

- Single-chip CMOS constructions
- Drives 3.5-digit duplexed LCD
- Low power dissipation (I_{DD} : Typ. 0.8 μ A, Max, 1.5 μ A; 1.55V)
- Colon display
- 32,768Hz crystal controlled operation
- Single 1.5V battery operation
- On-chip capacitive voltage
- Debounce circuitry on switch inputs doubled
- Protection against static discharge
- Built-in crystal oscillator π -network input capacitor
- Trimmer capacitor is used delectable (bonding option)

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Supply Voltage ($V_{DD1} - V_{SS}$)	V_{DS1}	- 0.3 ~ + 2.0	V
Supply Voltage ($V_{DD2} - V_{EE}$)	V_{DS2}	- 0.3 ~ + 4.0	V
Operating Temperature	T_{por}	- 20 ~ + 75	$^\circ\text{C}$
Storage Temperature	T_{stg}	- 55 ~ + 125	$^\circ\text{C}$

* Voltage greater than above may damage the circuit

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$, $V_{SS} = -1.5\text{V}$, $V_{DD} = 0\text{V}$; unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Voltage	V_{DD1}		1.2	1.5	1.8	V
Operating Voltage	V_{DD2}		2.4	3.0	3.4	V
Supply Current	I_{DD}	Without Load		0.8	1.5	mA
Input Low Voltage	V_{IL}		V_{SS}		$V_{SS}+0.3$	V
Input High Voltage	V_{IH}		-0.3		0	V
Switch Activation Current	I_{SW}	$V_{IN} = V_{DD}$	0.1	1.0	10	mA
Oscillator Start Voltage	V_{OSC}	Within 5 sec			1.45	V
Oscillator Stop Voltage	V_{OSP}				1.15	V
Oscillator Input Capacitor	CI			25		pF
Oscillator Frequency	F_{OSC}	CI = 25pF, CO = 20pF		32,768		Hz
DC - DC Conversion Frequency	V_{CON}	C1 = C2 = 0.1mF		512		Hz
LCD Frequency	FD			32		Hz
Switch Debouncing Time	TD				62.5	mS

FUNCTIONAL DESCRIPTION

Two switch (D and S) are required to control all display and setting of function.

DISPLAY CONTROL

• Standard Display

Normal IZ6099AU displays HOUR in digit 1, 2 and MINUTE in digit 3 and 4. In this state colon flashes at 1Hz rate.

Depression of the D switch in normal display state will cause month to be displayed in Digits 1 and 2, date in Digits 3 and 4, with colon off. Month and date will continue to be displayed for 2 seconds after the D switch is released. Then hour and minute are displayed again.

Two momentary depressions of D switch within 2 seconds in the normal display state will cause second to be displayed in Digits 3, 4 and the Digit 1 and 2 are blanked with colon not flashing. Depressing the S switch in this state resets and holds the second counter until S switch is released and minute counter is either advanced or remains unchanged, depending upon whether the second counter is greater or less than 30 seconds.

Depressing the D switch in this state returns the display to hr: min state.

• Alternating display

This mode is selected by activating the set switch (S) in the normal display mode. In this mode, hr: min is automatically displayed alternately with month date. Each is displayed for two seconds.

The S input must be activated five times to return to the normal display mode and depressing the D switch in this alternating mode will cause the second display mode to appear.

SETTING PROCEDURE

Time/calendar setting is accomplished by using the 6 switch to enter and return from the setting state. The D switch is used to advance the function at a 2Hz rate.

The function to be set is displayed the only one while setting state.

The detailed setting procedure is as follows.

a. Alternating display state

Depressing the S switch in normal display state calls MONTH set state and the display shows MONTH in the digit1 date)

b. Month

Depressing the S switch in the alternating display state calls up the month set state and the display shows month in the Digits 1 and 2. The month counter can be advanced at a 2Hz rate by depressing the D switch.

c. Date

The next depression of the S switch will select date set state the display shows date in Digits 3 and 4. The date can be advanced in Fig. 2.

d. Hour

The next depression of the S switch will select hour set state and the display shows hour in Digits 1 and 2 and A(AM)/P(PM) in Digits 4.

The colon flashes at a 1Hz rate. The hour can be advanced .

e. Minute

The next depression of the S switch will select minute set state and the display shows minute in Digits 3 and 4 and the colon flashes at a 1Hz rate. Depressing the D switch advanced the minute at 2Hz flashing and the watch suspends it's time-keeping function.

f. Hold mode

Then watch enters the hold state with the depressing of the S switch. In this state the display shows hour in Digits 1 and 2, minute in Digits 3 and 4 and non-flashing colon. (Normal display state).

NOTE

If minute is not changed in minute set state, the watch will not enter the hold state but will automatically revert to the normal display state.

The carry signal from any proceeding counter during operation is not accepted except for second reset.