

# OKI Semiconductor

## MSC1210

### Clock For 1/2 Duty VFD

#### GENERAL DESCRIPTION

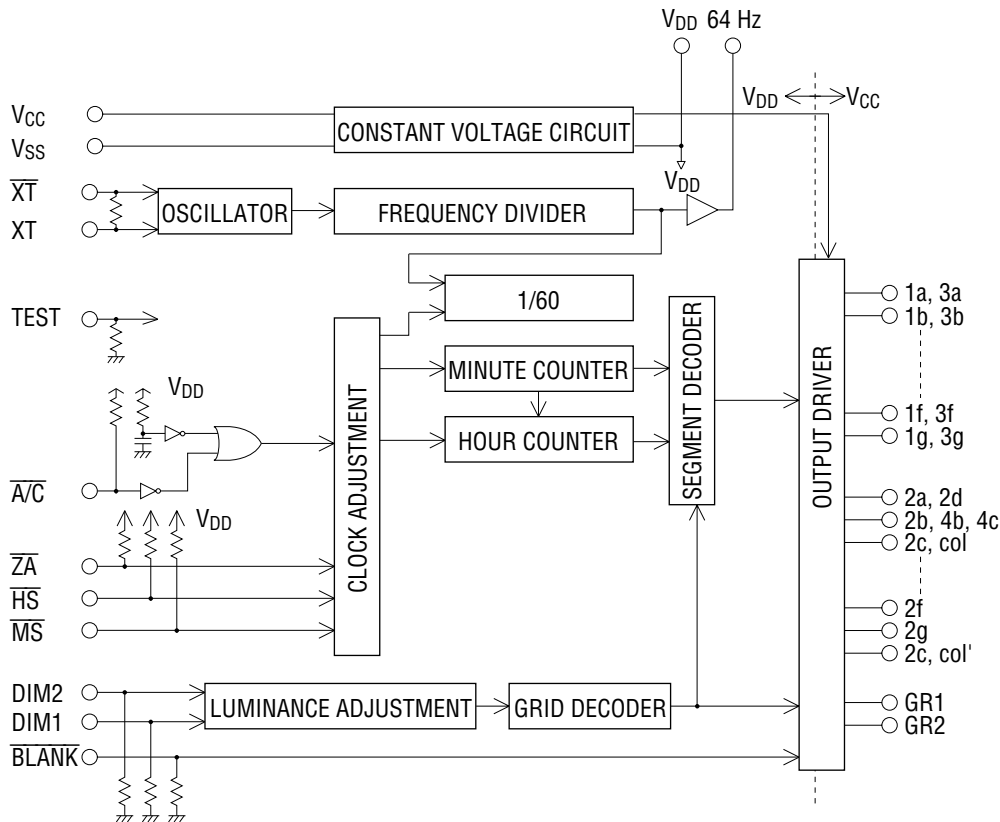
The MSC1210 is a clock for use in 1/2 duty VFD applications, featuring 4.194304 MHz crystal controlled oscillator time base, wide ranges of power supply, and 12-hour format. The clock correction ranges are minutes, hours, and a 30-min ADJ (30-minute adjustment). The two clock correction modes are available; one is 1Push-1ADJ correction mode, the other is 2 Hz fast advance correction mode.

The MSC1210 is also provided with a function of 4-degree-switchable VFD luminance adjustment.

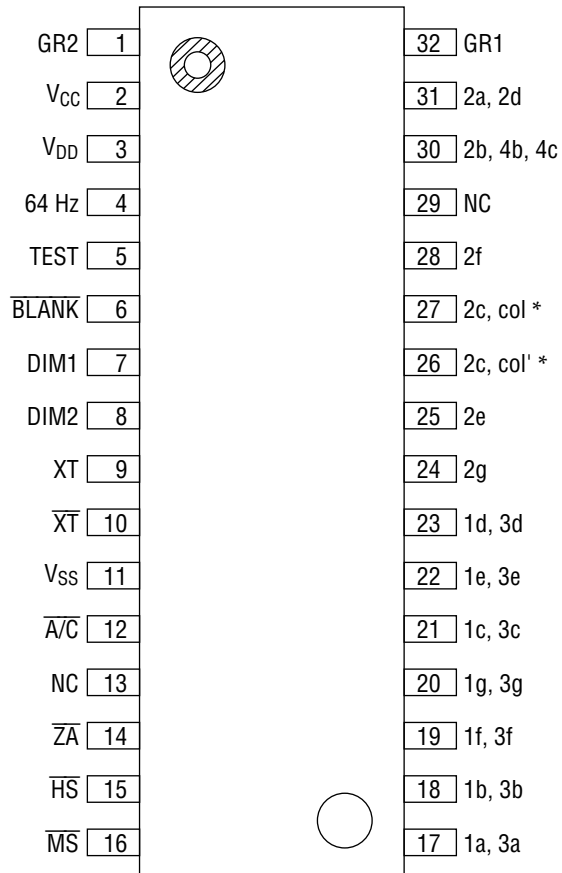
#### FEATURES

- 12-hour format
- Wide ranges of power supply: 4 V to 18 V (Built-in constant-voltage circuit)
- Usable for 1/2 Duty VFD
- 4.194304 MHz (crystal oscillation)
- Luminance: Switchable among 4 degrees
- Package options:
  - 32-pin plastic SSOP (SSOP32-P-430-1.00-K) (Product name: MSC1210GS-K)
  - 30-pin plastic shrink DIP (SDIP30-P-400-1.778) (Product name: MSC1210SS)

#### BLOCK DIAGRAM

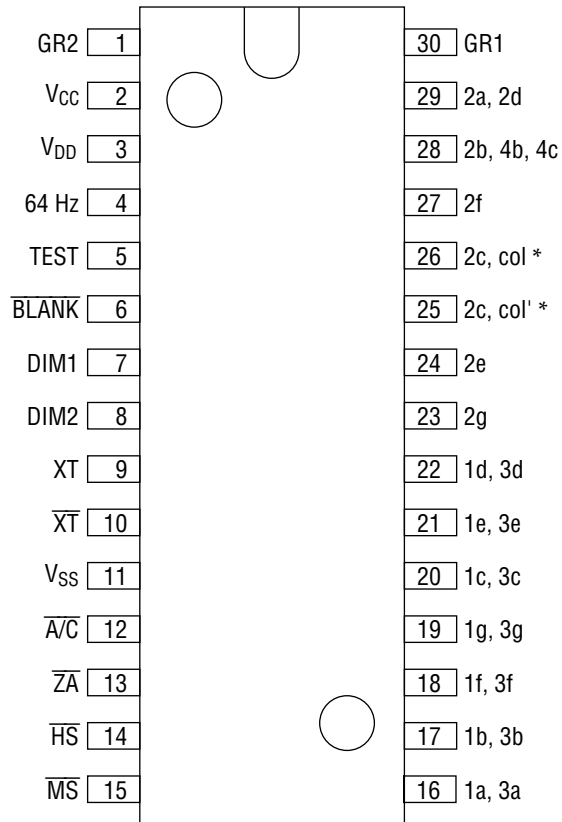


## PIN CONFIGURATION (TOP VIEW)



## 32-Pin Plastic SSOP

\* col indicates a blink colon and col' indicates a light colon.



### 30-Pin Plastic Shrink DIP

\* col indicates a blink colon and col' indicates a continuous light colon.

## PIN DESCRIPTION

Symbol	Type	Description
DIM1	I	Luminance switchover pins
DIM2	I	
$\overline{A/C}$	I	When this pin "0", the internal circuit is reset. The reset pulse width should be more than 2 $\mu$ s. This pin is internally connected to a pull-up resistor.
$\overline{Z/A}$	I	Zero adjustment pin. This pin is internally connected to a pull-up resistor
$\overline{H/S}$	I	Hour adjustment pin. This pin is internally connected to a pull-up resistor
$\overline{M/S}$	I	Minute adjustment pin. This pin is internally connected to a pull-up resistor
$\overline{BLANK}$	I	Blank input pin. When this pin is "0", the display disappears. This pin is internally connected to a pull-down resistor.
XT $\overline{X/T}$	I/O	These pins are used for crystal oscillation.
TEST	I	This pin is used to test the IC.
64 Hz	O	64 Hz signal output pin for oscillation frequency adjustment
GR1 GR2	O	Grid output pins for 1/2 duty VFD
1a, 3a to 2b, 4b, 4c	O	Anode output pins for 1/2 duty VFD

## ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	$V_{CC} - V_{SS}$	$T_a = 25^\circ\text{C}$	-0.3 to +24	V
Input voltage	$V_I$	$T_a = 25^\circ\text{C}$	-0.3 to $V_{CC} + 0.3$	V
Output voltage	$V_O$	$T_a = 25^\circ\text{C}$	-0.3 to $V_{CC} + 0.3$	V
Power dissipation	$P_D$	$T_a = 25^\circ\text{C}$	200	mW
Storage temperature	$T_{STG}$	—	-55 to +150	$^\circ\text{C}$

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Condition	Range	Unit
Supply voltage	$V_{CC} - V_{SS}$	—	4 to 18	V
Operating temperature	$T_{op}$	—	-40 to +85	$^\circ\text{C}$
Crystal frequency	f (X'tal)	—	4.194304	MHz

## ELECTRICAL CHARACTERISTICS

## DC Characteristics

(Ta = -40 to +85°C)

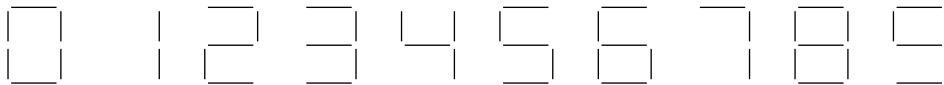
Parameter	Applicable pin	Symbol	Condition	Rating		Unit
				Min.	Max.	
"H" input voltage		V <sub>IH</sub>	V <sub>CC</sub> = 18 to 8 V	3.6	—	V
"L" input voltage		V <sub>IL</sub>	V <sub>CC</sub> = 18 to 8 V	—	1	V
Input current 1	DIM1, DIM2 BLANK, TEST	I <sub>IL1</sub>	V <sub>CC</sub> = 18 V V <sub>IN</sub> = 0 V	-1	—	μA
Input current 2	XT	I <sub>IH2</sub> I <sub>IL2</sub>	V <sub>CC</sub> = 18 V V <sub>IN</sub> = 5 V / 0 V	-3	+3	μA
Input current 3	$\overline{ZA}$ , $\overline{HS}$ , $\overline{MS}$ , $\overline{A/C}$	I <sub>IL3</sub>	V <sub>CC</sub> = 18 V V <sub>IN</sub> = 0 V	-200	-50	μA
Input current 4	DIM1, DIM2 BLANK, TEST	I <sub>IH3</sub>	V <sub>CC</sub> = 18 V V <sub>IN</sub> = 5 V	50	200	μA
Output current	SEGMENT	I <sub>OH1</sub>	V <sub>CC</sub> = 12 V V <sub>OH</sub> = 11.3 V	—	-1	mA
		I <sub>OL1</sub>	V <sub>CC</sub> = 12 V V <sub>OL</sub> = 0.7 V	15	—	μA
	GRID1, GRID2	I <sub>OH2</sub>	V <sub>CC</sub> = 12 V V <sub>OH</sub> = 11.3 V	—	-15	mA
		I <sub>OL2</sub>	V <sub>CC</sub> = 12 V V <sub>OL</sub> = 0.7 V	15	—	μA
	64 Hz	I <sub>OH3</sub>	V <sub>CC</sub> = 12 V V <sub>OH</sub> = 4 V	—	-100	μA
		I <sub>OL3</sub>	V <sub>CC</sub> = 12 V V <sub>OL</sub> = 0.5 V	100	—	
Dynamic current consumption		I <sub>CC</sub>	f = 4.19 MHz C <sub>g</sub> , C <sub>d</sub> = 22 pF V <sub>CC</sub> = 12 V	—	1.0	mA

**EXPLANATION OF FUNCTIONS**

- Time Base

Built-in 4.194304 MHz crystal oscillator circuit (AMP, feedback resistor)

- 7 Segment Display

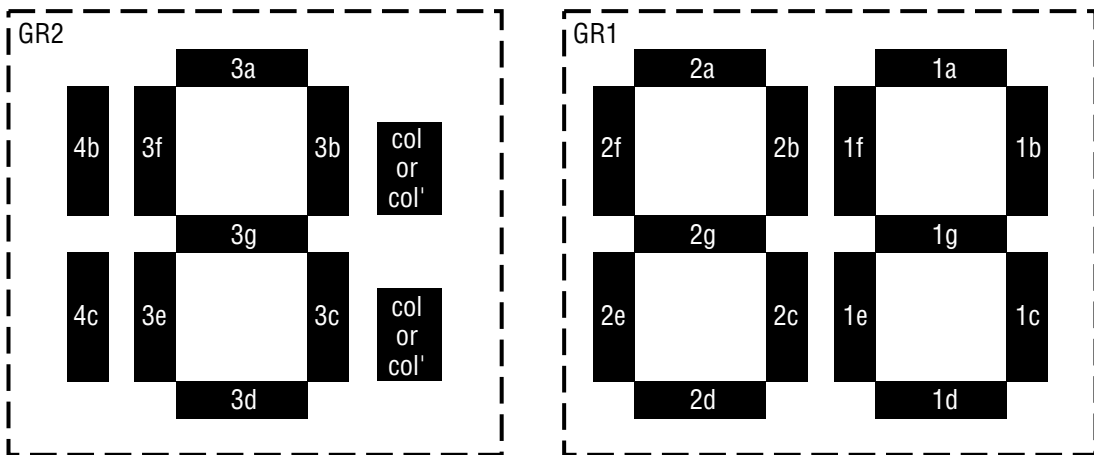


- Display Device

Dynamic drive 4-digit fluorescent display (with colons)

- Relationship between Anode & Grid Outputs and VF display Tube

**RELATIONSHIP BETWEEN ANODE & GRID OUTPUTS AND VF DISPLAY TUBE**



- Luminance Switch Function

4-degree switchable luminance (frequency = 250 Hz, gap width between GR1 and GR2 = 30 μs)

Switch pin name		Operation mode
DIM1	DIM2	
L	L	f = 250 Hz 1/2 Duty (50% display)
H	L	(25% display)
L	H	(12.5% display)
H	H	(6.25% display)

• Display Mode

4-digit display of hours/minutes on a 12-hour format.

Hours display ..... between 1 and 12

Minutes display ..... between 00 and 59

The most significant digit will not appear if it is zero. (Most significant digit zero suppress mechanism)

• Correcting Clock

Hour/minute fast advance function.

Hour digits and minute digits can fast advance, separately.

The hour digit can fast advance via  $\overline{HS}$  pin (Hour Set), and the minute digit via  $\overline{MS}$  pin (Minute Set) with 2 Hz period.

The hour counter or minute counter is incremented by 1 each time of pressing.

If keeping it depressed, these counters are incremented continuously with 2 Hz intervals.

The  $\overline{HS}$  and  $\overline{MS}$  pins, when they are open, are kept at "1" level with a pull-up resistor, and become non-active.

These pins become active when "0" level voltage is supplied from the external source.

The hour digit and minute digit can fast advance simultaneously.

In doing the fast advance operation, the low order digit of the counter continues a normal operation, but a carry out of the minute digit into the hour digit does not occur.

In doing the minute digit fast advance, a carry into the hour digit does not occur.

• Zero Adjust Function ( $\pm 30$  minutes Zero Reset)

The  $\overline{ZA}$  pin (Zero Adjust), when it is open, is kept at "1" level with a pull-up resistor, and becomes non-active.

This pin becomes active when "0" level voltage is supplied from the external source in order to execute Zero Adjust operation.

If the minute digits are smaller than 30, the minute digits and second digits are reset to 00'00".

If the minute digits are larger than 30, the minute digits and second digits are reset to 00'00", and a carry into the hour digit is executed.

Pre-second resetting of the counter is performed up to 16 Hz.

(Zero Adjust Example)

$$\left. \begin{array}{l} (X - 1) \text{ (hour) } 30'00'' \\ X \text{ (hour) } 00'00'' \\ X \text{ (hour) } 29'59'' \end{array} \right\} \longrightarrow X \text{ (hour) } 00'00''$$
  

$$\left. \begin{array}{l} X \text{ (hour) } 30'00'' \\ X \text{ (hour) } 59'59'' \\ (X + 1) \text{ (hour) } 29'59'' \end{array} \right\} \longrightarrow (X + 1) \text{ (hour) } 00'00''$$

- Blanking of Display

The display is blanked by externally applying "0" level voltage to  $\overline{\text{BLANK}}$  pin.

- 64 Hz Pin

Output pin for oscillation frequency adjustment.  
This pin always outputs a frequency of 64 Hz.

- Constant-Voltage Circuit

The constant-voltage circuit supplies the logic section with a voltage down to between 3.4 V and 5 V from between 4 V and 18 V.

- Power On Reset

No external capacitor is needed since the IC contains a capacitor.

- Test Pin

Used to test the IC.

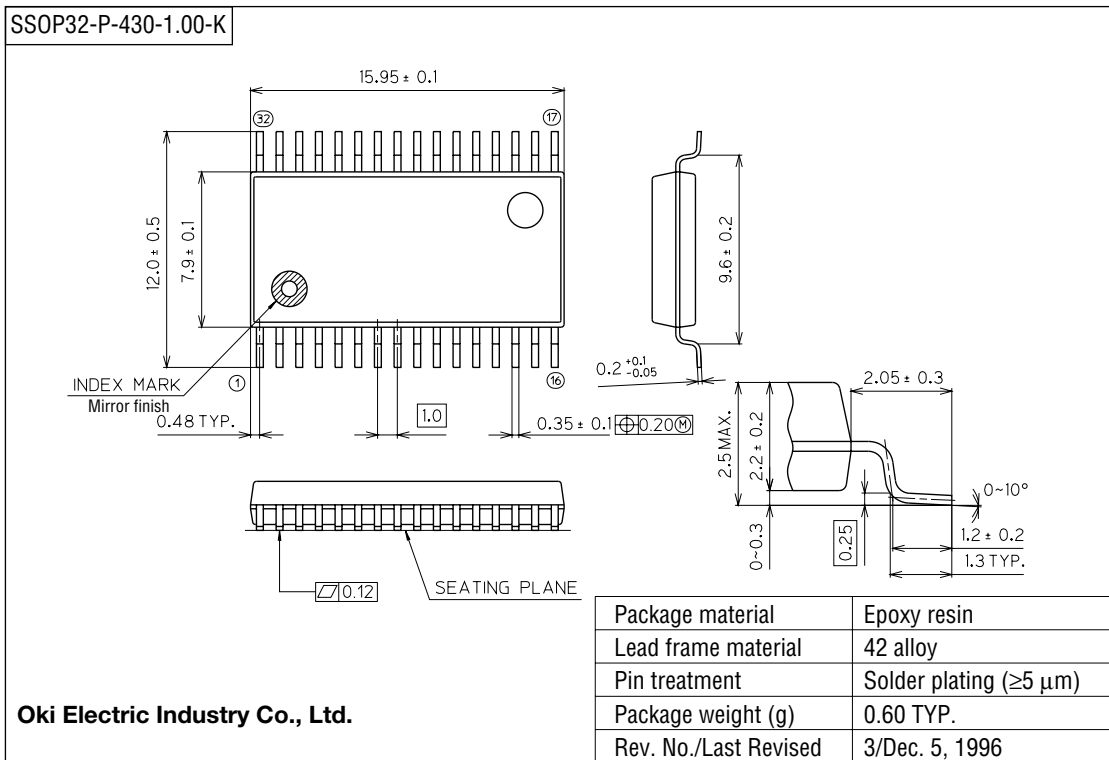
- Removal of Chattering

The  $\overline{\text{MS}}$ ,  $\overline{\text{HS}}$ , and  $\overline{\text{ZA}}$  input pins contains a chattering removal circuit, so that chattering of less than 31.25 msec is removable inside of the IC.



PACKAGE DIMENSIONS

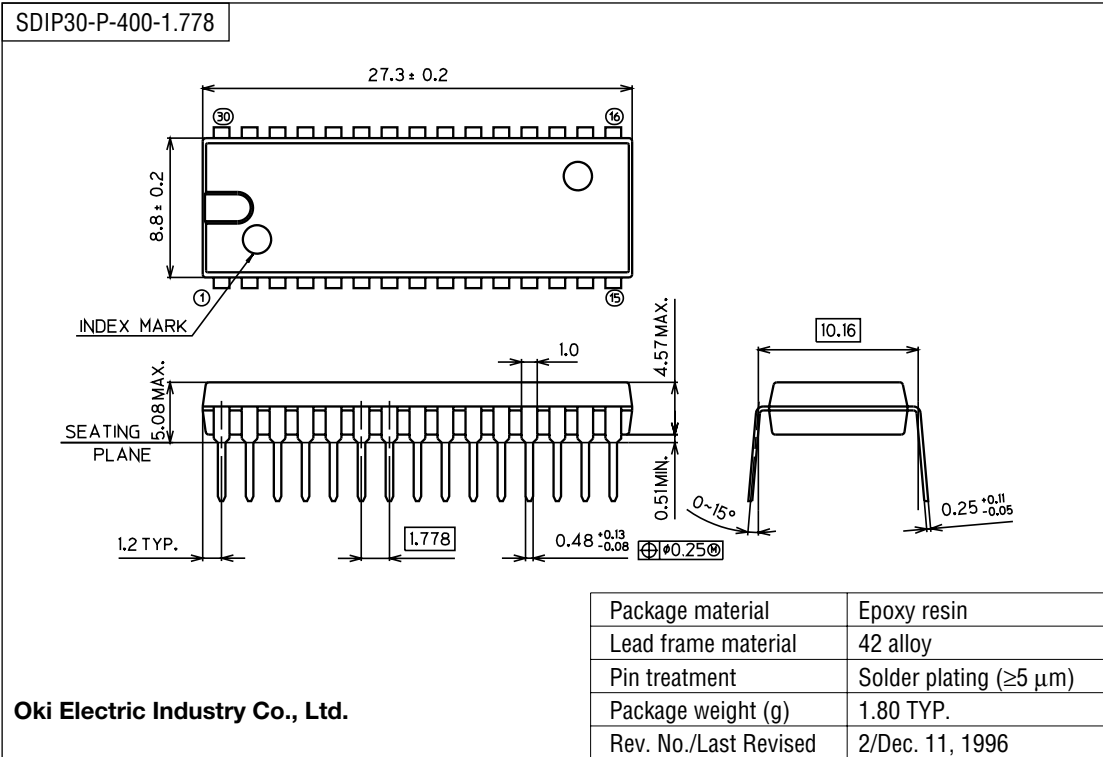
(Unit : mm)



Notes for Mounting the Surface Mount Type Package

The SOP, QFP, TSOP, TQFP, LQFP, SOJ, QFJ (PLCC), SHP, and BGA are surface mount type packages, which are very susceptible to heat in reflow mounting and humidity absorbed in storage. Therefore, before you perform reflow mounting, contact Oki's responsible sales person on the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

(Unit : mm)



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